AN EXAMINATION OF SOME FACTORS CONTRIBUTING TO THE SELECTION OF TOOLS FOR QUALITY

A Dissertation

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by

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Abstract

This dissertation examines some factors contributing to the selection of tools for managing for quality. What causes people to select the tools that they use has not been studied before. Two theories are Investigated, 1) that the selection of tools is dependent upon the educational background of the policy or decision making executive, and 2) that the selection differs between service and manufacturing organizations.

A multi-case, embedded case study design was used to perform a qualitative study of the theory. Six organizations participated in the study, two manufacturing and four service companies. In five organizations, three or four officers or managers were interviewed, a policy maker, a decision maker, a quality staff manager and a user. In three of the five cases the position of policy maker and decision maker were the same. In one case, a small manufacturer, all four positions rested in one individual.

One manufacturer and one service organization used the tools of quality management extensively to control and improve their processes. In these two cases, the background of the executive differed, one was scientific, the other not. Both had extensive training in process control and understood the concept of process. Since one policy/decision maker had no technical or scientific schooling while in the other the policy/decision

maker did have such schooling, the theory that the policy/decision maker's schooling is related to the selection of tools for managing quality is not supported. In the same way, since one company is a manufacturer and the other a service organization, the theory that there is a difference in the selection of tools for managing quality also is not supported.

Building upon the case studies, a third hypothesis for the selection of quality management tools is proposed. It is suggested that the selection of tools depends upon a quality champion's acceptance by top management. The champion may be in any level of the organization where he or she has access to top management (or be top management) and has the power to demonstrate the utility of the tools in the organization. The champion may need to be expert in the use of quality tools to control and improve processes rather than just products.

A review of the literature and the case study interviews suggests that the champion has the task of selling the concept and developing a critical mass of people who also understand processes and the tools needed to control and improve them. It takes time before the method of process control and improvement becomes part of the culture of an organization. Failure to get a critical mass and getting the cultural change results in a reversion to former practices.

The dissertation concludes that the concept of process is so little

understood that it would pay organizations that deal with quality issues, as well as the government, to make a concerted effort at educating executives. Executives rarely read (or believe) articles in quality magazines. To reach this audience, non-technical articles need to appear in trade journals and general media. The articles and books need to be based on valid theory to avoid misleading executives. The Union of Japanese Scientists and Engineers has done this successfully.

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CHAPTER 1

INTRODUCTION

This chapter traces the recognition by American managers of the significance of quality to business. Academic research also recognized this aspect of managing. Journals such as The California Management Review (Cole (Ed.), 1993) and the Academy of Management Review (Dean and Bowen (Eds.), 1994b) prepared special issues to cover the topic of quality. Dean and Bowen made the point, “Given the importance in practice, we risk losing our credibility as management theorists by ignoring TQ [Total Quality] in our research” (1994a, p. 393).

The chapter also presents some models for managing for quality. Early adopters, such as Ford and the Pontiac Division of General Motors are described and compared to later or, as Zbaracki (1997) calls them, institutional adapters.

Tamimi and Sebastianelli (1996) used students to survey service and manufacturing firms to see how they define quality. This chapter discusses some of this work. Finally, the chapter looks at top management’s role in achieving quality.

From these topics, the writer then formulates the research questions or hypotheses.

Quality as a Management Issue

Before 1980, few if any American managers considered quality as a function of management actions. Where quality was a consideration, managers thought in terms of product quality. Most anagers considered quality as a function of design and production.

In fact, many managers were confused by the fact that the word, “quality” can be used as both a noun and an adjective. When used as an adjective, it denotes a superior characteristic of product or service, a feature. As a noun, quality “denotes a character with respect to fitness or grade of excellence.” (The Random House College Dictionary, 1975). When managers said that they could not afford any more quality, they were usually talking about the product’s *features*.

Global Competition and Our Initial Reaction

In the period preceding 1980, many managers became concerned with foreign competition, principally coming from Japan. The Japanese, who once had a reputation for the worst quality of products, in a period of decade or two turned around this image and competed with American manufacturers on many fronts such as automobiles, electronics, optical goods, etc.

During the 1970's, American managers sent study missions to Japan to learn the secret of their quality and productivity (Dewar, 1980, p. 12). As Dobyns and Crawford-Mason described it, “When American executives began to visit Japanese factories in the 1970s to find The Answer [sic] to Japan’s exceptional quality and manufacturing, they first focused on quality circles” (Dobyns et al., 1994, p. 41) This method was called “QC Circles” by the Japanese (Ishikawa, 1983). QC Circles are a group of individuals who meet to discuss and solve problems in their operation. Tachiki dates their beginnings to 1961 when “JUSE [The Union of Japanese Scientist and Engineers] officially announces the development of small group activities called Quality Control Circles” (Tachiki, 1990, p. 2)

The different nomenclature used by American and Japanese managers gives a clue to the way the notion of quality was perceived by them. For the Americans, it was a means to the end of improving quality or, more likely, productivity. By contrast, the Japanese regarded it as the third step (out of six and, since 1987, ten steps) in their “Pyramid of Quality” model (Tachiki, 1990, p. 9), built upon Company-Wide Quality Control and Statistical Process Control.

The difference in the American approach resulted in very few

success stories by 1980, with many failures. Many American QC circles just faded away. This was often to the relief of management, who did not know how to stop the process. The writer published a paper in 1981 entitled “Quality Circles Won't Work Without Quality Control” (Latzko, 1981). This work outlined the problem when using QC circles as a stand alone system. Dobyns and Crawford-Mason agreed with this view when they said, “The Americans who went to Japan had used analysis to study the system and found one part. They did not use synthesis so they missed the whole and in continual improvement, the whole is greater than the sum of its parts” (Dobyns et al., 1994, p. 42).

Professor Kano, the mentor of Florida Power & Light in their quest for the Deming Prize, put it this way: “Gradually, however, many of [the American Managers] learned that promoting quality circles alone was not sufficient to achieve quality” (Kano, 1993, p. 21). Professors Lawler and Mohrman (1985) found that without a guiding model, such as the Pyramid of Quality, Quality Circles migrate into other forms of participation, such as business teams or task forces. Kano (1993, p. 21) attributes this to a lack of what happens when quality circles are introduced without a Company-Wide Quality Control base.

“If Japan Can . . . Why Can’t We?”

On June 24th, 1980, NBC aired an 90 minute white paper called, “If Japan Can … Why Can’t We?” (Crawford-Mason et al., 1980). Claire Crawford-Mason is quoted by Mrs. Killian as writing “In the 1970s, Americans had found two easy targets to blame for their economic woes: inflation and high energy costs. . . . Other people interviewed pointed to the adversarial relationship between government and industry” (Kilian, 1992, p. 15). Mrs. Crawford-Mason goes on to describe that while 14 million households viewed the program (a reasonable number for a documentary according to her), the show went on to become the most requested program of all time. “One reason this program has generated so much continued interest is because of the powerful, relevant message of one man who was featured in the documentary: Dr. W. Edwards Deming” (Kilian, 1992, p. 17).

The show made Dr. Deming prominent. Until it was aired, he was little known in the United States, although Japanese managers were very much influenced by him. In 1950, Deming was the first of several experts to visit Japan. Tachiki (1990) reports that in 1954, Dr. Joseph M. Juran delivered lectures on “Quality Control and Management,” followed by Dr. Armand V. Feigenbaum in 1961. While these three people and others had

a profound influence in Japan, their work was largely ignored by American managers. The NBC white paper brought their work, particularly Deming's work, to the attention of American management.

The increasing popularity of Deming aided him in influencing managers in a number of key industries. In a personal communication, Dr. Deming told the writer that his strategy was to work with a major American manufacturer, so that he could influence the supplier base of this manufacturer. Ford Motor Company and the Pontiac Division of General Motors were two such manufacturers. In addition, Deming gave a series of four day seminars (initially the seminars lasted only three days, but that proved insufficient to cover the material he had to present.)

Deming's 14 Points

Deming presented American managers with a series of principles designed to help managers achieve quality in products and services. These rules were quickly labeled "Deming's 14 Points." Some of the propositions were quite obvious while others were widely questioned.

Professor Joyce Orsini of Fordham University stated at a seminar on Dr. Deming's philosophy that there was nothing magical about the number "14". The number initially varied. When his first book on the

subject (Deming, 1982) had to go to press, the list had 14 points, and so it remained.

Dr. Deming was forever clarifying these points, in order to bring their meaning into a sharper focus. Latzko and Saunders (1995, Chapters 3, 4 and 6) wrote a book about Deming's four day seminars. This was reviewed by Dr. Deming, and it contains the latest version of the 14 Points, which are as follows :

1. Create constancy of purpose.
2. Adopt the new philosophy.
3. Cease dependence on mass inspection.
4. End the practice of awarding business on the basis of price tag alone–Instead reduce cost by reducing variation.
5. Continual improvement.
6. Institute training for a skill.
7, Adopt and institute leadership.
8. Drive out fear.
9. Break down barriers between staff areas.
10. Eliminate slogans, exhortations, and arbitrary targets.
11. (a) Eliminate numerical quotas for the work force. (b) Eliminate numerical goals for people in management.

12. (a) Remove barriers to pride of workmanship. (b) Drop the annual merit review.
13. Encourage education and growth
14. Take action to accomplish the transformation

The 14 points are a prescription for managers to follow to achieve good quality and productivity. Initially, point 4, “End the practice of awarding business on the basis of price tag alone–Instead reduce cost by reducing variation”, was met with great resistance. However, when Ford Motor Company and General Motors followed this plan and benefitted from it, the plan became an accepted way of doing business in the automotive industry and other industries followed their lead (Sen & Latzko, 1989) .

Today, point 12(b), “Drop the annual merit review”, is the point troubling many managers. Some large firms, such as the Power-train Division of General Motors, have adopted this mode with great success. (Mary Jenkins, personal communication, October 7, 1991 at a meeting of GM and Branch Bank & Trust Company Executives.) Another case cited by Scholtes (1998) shows that Marshall Industries, distributor of industrial electronics eliminated performance evaluations, promotions and contests and nearly doubled sales and earnings.

Deming's System of Profound Knowledge™

The 14 points are the outcome of a management theory. For years Deming told his audience to get someone with "profound knowledge" to help achieve a transformation. On 24 July 1989, Dr. Deming's daughter read a paper for him at the meeting of the Institute of Management Sciences in Osaka, Japan (Latzko & Saunders, 1995). This paper contained the first written statement about the "System of Profound Knowledge," Deming's theory of management.

Over the years, he polished and expanded the original work until it became a book, The New Economics for Industry, Government and Education (Deming, 1994). Deming revised the text, and the second edition was published shortly after his death in December 1993.

The System of Profound Knowledge is composed of four components, all of which are interrelated. These components are,

- Systems
- Variation
- Theory of knowledge
- Psychology

Deming maintained that one need not be a master in each separate area to understand the principles and how they work together.

Rather, he maintained that it is the interaction among the components that allow managers to act in a logical manner.

Management Recognizes the Importance of Quality.

As usual, early adopters gained an advantage. Zbaracki (in press) points out that in theory, early adopters will follow quality initiatives for technical reasons. Berwick (1998), citing Rogers' 1995 book on Diffusion of Innovation, discusses that after the early adopters comes the "early majority", who debate the value of adoption *before* completely accepting the innovation. The early majority is then followed by the late majority, who adopt the innovation because of peer pressure.

In the case of quality as a management issue, Stoner and Wankel (1990) observed,

> Over a forty year period, the role of quality as a dimension of competition has evolved through three stages. Initially quality was seen as one of many "alternative" characteristics of products and services companies could base their strategies upon. By the early 1980's quality was beginning to be seen as virtually "the key" basis of competitive success. By the early 1990's it is starting to be seen as a "necessity" almost to be taken for granted the price of getting into the game but no guarantee of long-term success. (p. 8-1)

This "Alternative to Advantage to Necessity" describes the diffusion of the importance of quality as a management issue very well. In the world

of global competition, we are in the *necessity stage* with respect to quality.

A powerful force persuading the early and late majority alike was the adoption by the military establishment of the principles of the Deming concept of managing for quality. Dr. Steven L. Dockstader (personal communication, 18 March 1998) informed the writer that under military regulations, the name “Deming” could not be used to describe the process. An alternative was found in 1985, and the process was thusly called “Total Quality Management” (TQM). With the issuance of the military standard DoD 5000.51-G, “Total Quality Management Guide” (1989), suppliers to the military establishment had to adopt TQM.

Academic Research

With so many managers dealing with the quality process, academic researchers started to turn their attention to the issue of managing for quality. By the early 1990s, this issue was often contained in some notion of TQM. Yet the very use of this terminology bothered a number of researchers. Dean and Bowen (1994a) called the process “TQ”. Kano (1993) recognized it as “Total Quality Control” or TQC. In his paper, he used the term “TQM” to avoid confusing the American reader. Kemper (1997) in his massive meta literature study distinguished among TQC,

TQM, and "Quality[1]" (the word quality with a superscript 1), and other notions. He defined "Quality[1]" as "based on the works of W, Edwards Deming and a number of his followers" (Kemper, 1997, p. ix). These issues will be discussed in more detail in the next chapter.

Dean and Bowen (1994, p. 393) make the case for academic research in this area for three reasons:

(1) the interest in quality in so many sectors of the economy makes it worthwhile;

(2) They felt that there is a great amount of overlap between what they call "TQ" and management theory; and

(3) "theory development on total quality should benefit both researchers and practitioners."

Thus they make the important point that without theory, there is no way of knowing why some initiatives succeed while others fail (Dean & Bowen, 1994a, p. 393).

It is interesting to note that Dean and Bowen (1994a) differentiate between practice of what they call "Total Quality" (TQ) and management theory. They say:

> Perhaps the fundamental difference between TQ and management theory is in their audiences. Whereas TQ is aimed at managers, management theory is directed to researchers, with the expectation

> that ideas relevant to practitioners will, through teaching or perhaps consulting, eventually find them. (p. 396)

The implication that management theory has some ideas which are not relevant to practitioners seem strange to this writer. One would think that eventually, management theory *is* relevant to practitioners, even if at first it does not appear to be relevant.

Professor Donald C. Hambrick in his 1994 presidential address, "What if the Academy [of Management] Actually Mattered", stated

> We must recognize that our responsibility is not to ourselves, but rather to the institutions around the world that are in dire need of improved management, as well as those individuals who seek to be the most effective managers they can possibly be. It is time to break out of our closed loop. It is time for us to matter. (p. 13)

Barley, Meyer and Gash (1988) studied 192 articles written on organizational culture. Their analysis indicated that, " . . . the data suggest that conceptual and symbolic influence flowed only in one direction: from practitioners to academics." They continued their discussion, writing: "Consequently, at least with regard to theory and research on organizational culture, the data are consistent with the political theorist vision: practitioners do appear to have had more influence on organizational theorists than the latter have had on the former." (p. 52).

Barley et al. (1988) look at two other possible explanations:

(1) change in academic discourse and

(2) demographic arguments.

Ultimately, they come back to the point that, “. . . the convergence occurred primarily because the academic community adopted a perspective more like that of practitioners . . . ” (p 54). In fairness, they point out that they do not know the “processes that led to the conversion”, nor that a single study is particularly conclusive. (p. 55).

Barley et al. (1988) and Hambrick (1994) bring out the point that while ideally management theory can be independent of practitioners needs, in practice, they are closely allied. Thus practitioners, at least in some instances, actually lead the theorists. The writer believes that this indicates that an alignment is necessary between the theorists and the practitioners of management.

This writer sees academic research serving essentially two key purposes:

(1) to put diverse concepts into a formal context that might otherwise not exist, and

(2) to use the model that is created to explain the underlying principles contributing to the success or failure of given

activities. In the case of TQM, a number of studies have examined why failure occurs (e.g. Abrahamson, 1996, Brown, Hitchcock, & Willard,1994, Choi & Behling, 1997, Krishnan, Shani, Grant, & Baer, 1993).

Models Related to Quality

There are several ways in which models for quality are presented. Some of these models represent methodological structure while others are more organizationally oriented.

Tachiki's Pyramid of Quality

Tachiki (1990, p. 9) presents a "Pyramid of Quality", a methodological model, consisting of six unique quality control practices. This is shown in Figure 1 on the next page. The model in Figure 1 was adopted by the Union of Japanese Scientists and Engineers (JUSE) at a 1968 QC Symposium (Tachiki, 1990). The pyramid contains four of the six quality control practices in order of application:

(1) Company-Wide Quality Control,

(2) Statistical Process Control,

(3) Quality Control Circles, and

(4) Quality Control Audit. The other two practices ,

(5) QC Education and Training and

(6) National QC Promotion Activities, are represented as arrows.

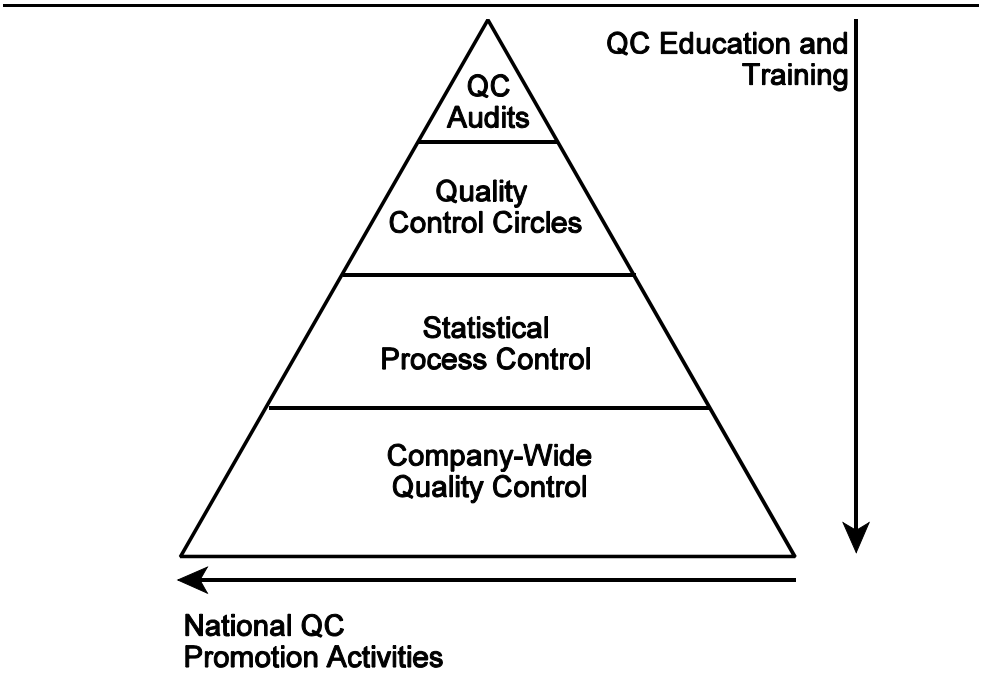

Figure 1 Pyramid of Quality

Source: Adopted from Tachiki, D. S. (1995). Total Quality Control: The Japanese approach to continuous improvement. Tokyo: Sakura Institute of Research. p. 9.

This is because they are applicable to *all* activities, and thus, they are not in sequence, as are the four practices in the pyramid.

Under Company-Wide Quality Control, Tachiki understands this to

be principally the method known as Quality Function Deployment (QFD) (1990, p. 10). He also includes a concept called “Cross-functional management.” He explains this as an outgrowth of QFD as follows:

> The benefits of the QFD method are clear. Nevertheless, when a company initially introduces this method, it usually encounters difficulties in getting department heads to cooperate with each other. Moreover, the technical staff is not always timely in providing quality control data to managers and line workers. To address this issue, in 1963, the Toyota Motor Corporation pioneered the introduction of management by cross-functional areas. This has evolved into what is today known as cross-functional management.
>
> Cross-functional management is a method for linking departments or divisions within a company across functions. ... there are two main components to this matrix: cross functions and organizational divisions. Cross-functions refer to the key management areas (e.g., quality, cost, delivery, personnel management). The organizational divisions refer to the units responsible for each step in the product development cycle. (Tachiki, 1990 p. 11)

Statistical Process Control

Under the concept of Statistical Process Control (SPC), Tachiki includes the application of Ishikawa’s Seven Tools of Quality, the Seven New Tools, Sample theory, Design of Experiments, Multivariate Analysis, “various methods of operations research (OR)” (1990, p. 13).

Quality Control Circles

The concept of Quality Control Circles is widely attributed to Dr. Kaoru Ishikawa, who is often called the father of Quality Control Circles.

These circles consist of a group of employees working on specific quality improvement projects.

The writer was present at the 1982 Annual Quality Congress of the American Society for Quality, when Dr. Ishikawa was asked to comment on the Quality Control Circles in Japan. Dr. Ishikawa went to a flip chart and drew a concentric circle graph. He placed management in the center, SPC in the next ring, and quality circles in the outer ring. He emphasized that the key to Japanese quality was first the role played by management, second the use of Statistical Process Control, and last the application of Quality Control Circles. “The latter”, he said, “accounted for no more than 10% of success in achieving quality” (Kaoru Ishikawa, personal communication May 4, 1982). This came as quite a surprise to American Quality Professionals.

The Quality Control Audit

The Quality Control Audit follows the concept of the Shewhart Cycle. This cycle was introduced to the Japanese in Deming’s 1950 lecture series (Koyanagi, 1960, p. 9). This cycle is often called “The Deming Wheel” by the Japanese (Tachiki, 1990, p. 6). The Shewhart Cycle has the sequence of (a)design, (b) make, (c) sell, and (d) test in

service. The data from testing the product or service in use allows for redesign and a repeat of the cycle. Around 1980 the cycle was modified to what Deming called the Shewhart Cycle of Learning (cf. Deming, 1992, p. 88). This cycle is often called P-D-S-A after its four elements,

- Plan,
- Do,
- Study, and
- Act.

The relationship between Shewhart's original cycle and the later version is briefly discussed in Latzko and Saunders (1995, p. 5).

The Quality Audit, as seen by the Japanese, follows the "test in service" notion. Western quality theory also uses such audits, but these are quite different in scope from the Japanese version of Quality Audit. In the Japanese version, the audit is conducted by senior managers and decision makers. The purpose is to see what changes are required to obtain the aims of the company. Thus, "the most comprehensive evaluation is the **President TQC Audit** [emphasis in the original text]. The president and senior executives conduct this audit of all units in the company" (Tachiki, 1990, p. 19).

This is very different from the external audits required for the Malcolm Baldrige National Quality Award, ISO 9000 series, the Deming

prize, and other similar events. It differs also from the usual American style internal audits, which are usually conducted by people from staff areas or outside consultants. The writer knows of *no* documented case where the president or head of department of a Fortune 1000 firm performed a Quality Audit.

The National Quality Promotion Activities

The National Quality Promotion Activities represent JUSE's commitment to the encouragement and diffusion of methodology required to obtain top quality. Tachiki (1990, p. 8) reports that JUSE accomplished this through fitting best practices to the "Japanese business environment and diffusing it through low cost publications and training courses." For instance, he reports that supervisors could listen to quality training courses offered via the Japanese Broadcasting Corporation (NHK) and could buy the accompanying text for the price of a package of cigarettes so that foremen could afford it (Tachiki, 1990, p. 17 footnote).

In addition JUSE serves as the Secretariat for the prestigious Deming Prize, which they founded in 1950. Koyanagi, who as JUSE's Managing Director was responsible for bringing Dr. Deming to lecture in Japan in 1950, writes that the royalties from the transcript of Dr. Deming's

Lectures in 1950 “. . . amounted to a sizable amount, and Mr. Koyanagi naturally offered to pay them. But Dr. Deming declined to receive them and donated them to be used freely for any conscientious purpose” (Koyanagi, 1960, p. 7). The purpose was to use the funds as a basis for the creation of Japan’s Deming Prize.

The Deming Prize and the low cost access to learning about quality are the main National QC Promotion Activities by JUSE. In contrast, activities the United States are administered by separate groups. The Malcolm Baldrige National Quality Award (MBNQA), the American equivalent to the Deming Prize, is administered by the National Institute of Science and Technology (NIST). The educational resources and publications of the American Society for Quality (ASQ) are the equivalent of JUSE’s efforts in the field of education.

The MBNQA is structured quite differently from the Deming Prize. A major difference is that only two firms in any one category can win the MBNQA, while any company that qualifies can get a Deming Prize. Tachiki (1990, p. 21) provides a table comparing the Deming Prize, the Malcolm Baldrige National Quality Award and ISO 9000 series of standards. Nakhal and Neaves (1994) also give a comparison of the Deming Prize and the MBNQA. Instead of the ISO 9000 series of

standards, they use the European Community Model. The order and wording of the Deming Prize elements differs slightly from Tachiki's, but the essentials are the same.

The educational resources and publications of the ASQ are priced to provide an operating profit. In contrast, JUSE pricing considered the ability of workers to afford the material.

QC Education and Training

The sixth element of the Pyramid of Quality is QC Education and Training. Training is taken very seriously in Japan. Juran (1981) feels that one of the reasons that Japan was able to do so well in so short a time was that they undertook a massive training program for managers and supervisors. Kondo (1988, p. 35F.10) lists a table of JUSE courses ranging from a 2 days to 30 days.

In 1987, JUSE added four more elements to their model: "(7) quality-first principal of management, (8) policy deployment and managing by policy, (9) quality assurance throughout the product cycle, and (10) extension of QC from manufacturing to other industries" (Tachiki, 1990, p. 10).

Deming's Flow Diagram

While the "Pyramid of Quality" represented a methodological model, Deming presented an organismic model of TQM. Initially, this model was an in-line type as shown in Figure 2 below. The model was similar to standard operations management models, except it displayed more of the environment than is normally seen in an operations management model.

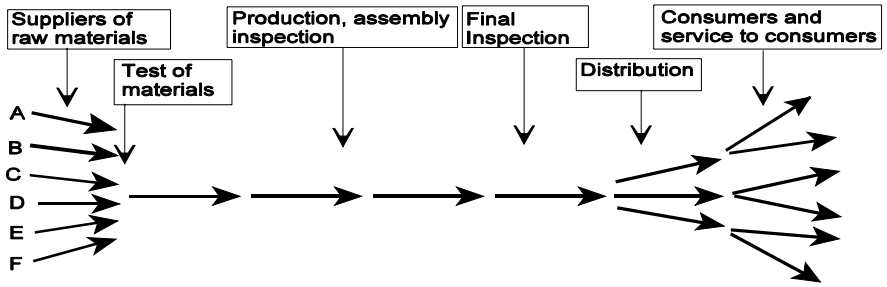

Figure 2 The Process Flow Chart

Source: Adopted from Deming, W. E. (1952) Elementary principles of the statistical control of quality. Tokyo: JUSE. p. 3.

In addition to this system flow diagram, Deming also presented a second part of his systems model. He called it the "Shewhart Cycle" (Latzko et al., 1995) although the Japanese quickly termed it "The Deming Wheel" (Tachiki, 1990). Deming taught the Japanese on 1950 that the mechanistic model shown in Figure 3 on the next was no longer

considered useful (Deming, 1951, p. 8)

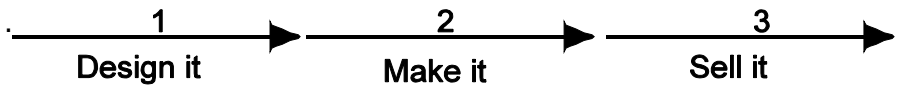

Figure 3 The Old Way

Source: Adopted from Deming, W.E. (1951) Elementary principles of the statistical control of quality. Tokyo: JUSE, p. 8

1. Design the product (with appropriate tests)
2. Make it, test it in the production line and in the laboratory
3. Put it on the market
4. Test it in service through market research, find out what the user thinks of it and why the non-user has not bought it
5. Re-design the product, in the light of consumer reactions to quality and price

Continue around and around the cycle.

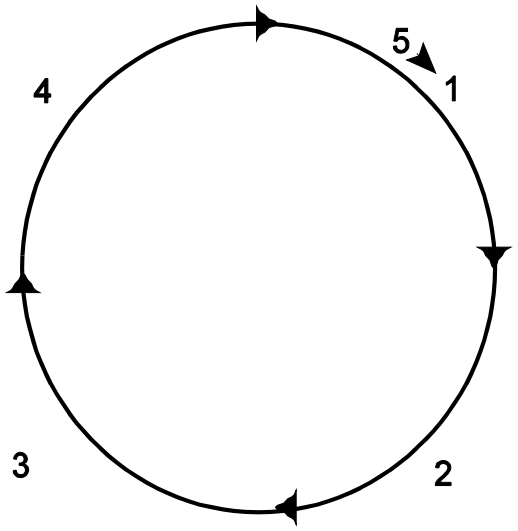

Figure 4 The New Way. This is also called the Shewhart Consumer Cycle. The Japanese called it the “Deming Wheel.”

Source: Adopted from Deming, W. E. (1951). Elementary principles of the statistical control of quality. Tokyo: JUSE. p. 9.

In his 1950 lectures, Deming showed the Japanese that Shewhart had a more organismic model in mind. Latzko and Saunders called this the Shewhart Consumer Cycle to distinguish it from the Shewhart Cycle of Learning (1995, p. 5). Figure 4 on the previous illustrates the Shewhart Consumer Cycle as shown to the Japanese in 1950.

Deming realized that the two concepts as shown in Figure 2 and Figure 4 actually work together to form a single organismic model. By the

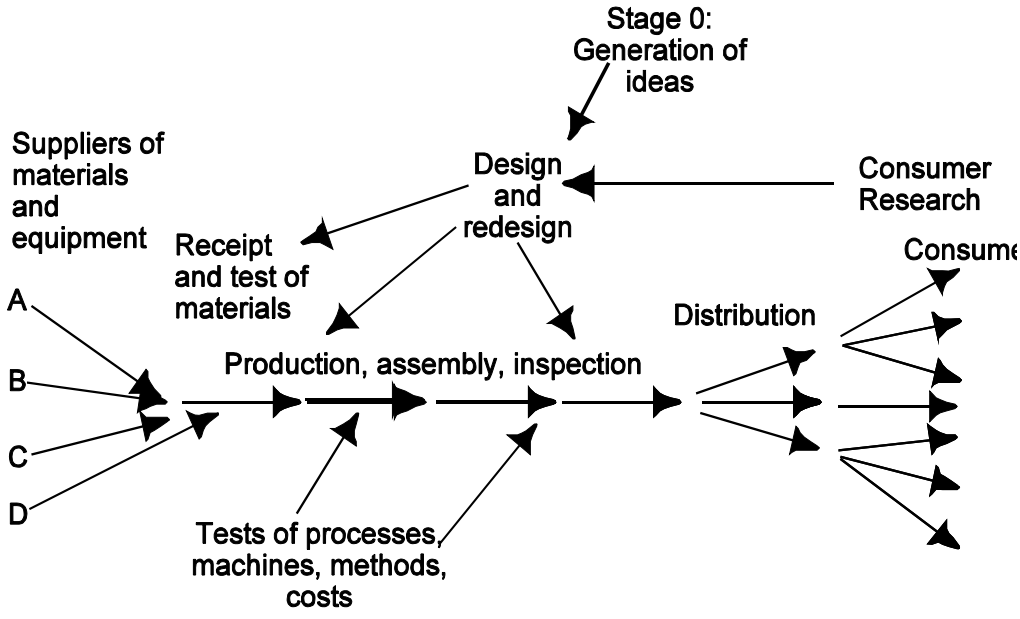

Figure 5 Production viewed as a system.

Source: Adopted from Deming, W. E. (1994) The new economics for Government, Industry, Education. Cambridge, MA: MIT Center for Advanced Engineering Study. p. 58.

time Deming published his book, Quality, Productivity and Competitive Position, the two concepts were merged by what he later called Flow Diagram and at the time labeled, “Production viewed as a system” (Deming, 1982, p. 103). In his last book (Deming, 1994, p. 58), he added the concept of the “Stage 0, Generation of ideas.” This he considered the initial or beginning stage of the system. As presented above, Figure 5 illustrates the Deming Model.

Professor Barbara A. Spencer reviewed models of organization in relation to TQM (Spencer, 1994). She posed the following question: “Why do practitioners view TQM as a new paradigm, whereas many academics view it as old hat?” (Spencer, 1994, p. 458). Spencer feels that the reason lies in that TQM owes a lot to systems theory, and in particular, the organismic model. Spencer (1994) finds that:

> After all, the systems perspective has grounded much of the thinking and research on organizations since it was introduced to the management literature in the 1950s. That key components of Deming's quality concept derive from this same model is probably no coincidence given that his work with the Japanese began in that decade. His flow diagram [Figure 5] evokes instant recognition as an organizational system embedded in a broader environment. (p. 458)

Professor Spencer recognizes Deming’s use of systems approach when she says, “Deming's work, in particular, seems to graft mechanistic

and organismic concepts into a coherent whole" (1994, p. 467). Spencer goes on to conclude,

> While using these models to explore TQM, I made an unexpected discovery: the study of TQM can teach researchers more about the existing management models. For example, the mechanistic model is generally presented in a negative light (e.g., Perrow [1973] equated mechanistic thought with the forces of darkness). Yet Deming (1982, 1986) placed great emphasis on reducing variation--a mechanistic idea. Like Fayol and others, he viewed management in terms of principles, implying that there may yet be some basic components of effective operation in all organizations. Perhaps more consideration of these ideas is warranted. (p. 468)

The Integrated Process Management Model

Although described by Hessel, Mooney, and Zeleny (1988) and Zeleny (1988), Professor James Stoner informed the writer that the term, Integrated Process Management, was coined in a meeting at Fordham University to describe the quality paradigm (personal communication July 27, 1998). The concept of Integrated Process Management (IPM) is that all components of the process **and** its environment be integrated.

Hessel et al. (1988) describe IPM as being customer oriented in the truest sense. If one wants to be competitive, they maintain, "the emphasis is unmistakable and self-evident: the customer is **the** purpose **and** driving force of the enterprise and must be integrated into the process of production and service delivery" (p. 142) (Emphasis added).

Zeleny (1988) also proposes the integration of all components of the process and its environment. He describes the traditional input-output model and criticizes it, observing: “Such linear and one-directional scheme is characterized by a well defined motive (plan), beginning (inputs), process (transformation), end (outputs) and object (customer) - all separate and disconnected entities” (p. 265). He then defines, “the problem lies not with any of [these] components, but with the interconnecting system: customer remains an object, separated ‘out there’ in the environment.” He goes on to describe an information loop needed to learn about the customer in such a system. As he says, “The purpose is not to manage inputs, or outputs, or process, nor any of these components in their interaction; the purpose is to manage the entire loop as a system” (p. 266).

The Baldrige Criteria Model

The Malcolm Baldrige National Quality Award (MBNQA) was founded to follow the example of Japan’s Deming Prize in encouraging companies to pay attention to management issues related to quality. The National Institute of Standards and Technology (NIST) was assigned the responsibility for the award. Each year, they publish a booklet describing

the award and detailing the rules for obtaining it.

Past issues and this year's booklet describe what is called, "A System Perspective" which includes a diagram of the system (Malcolm Baldrige National Quality Award 1998 Criteria for Performance Excellence, 1998, p. 43). Figure 6 (displayed below) shows the seven components of the award, depicted an interlinked relationship. Some of the environmental components, such as customer and market focused strategy and action plans are displayed as a shaded area above the seven components. The environmental components are linked to component 1 "Leadership" and component 7 "Business Results." This

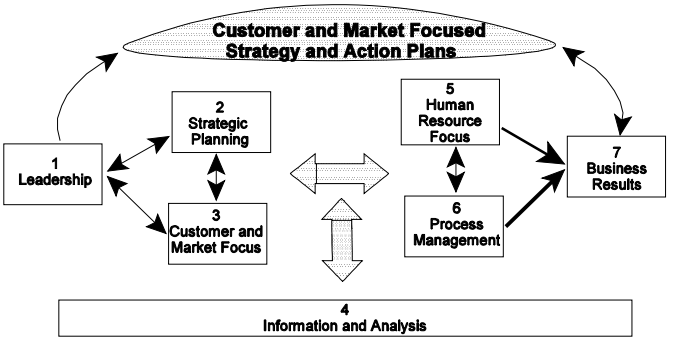

Figure 6 Baldrige Criteria for Performance Excellence Framework: A Systems Perspective

Source: Adopted from Malcolm Baldrige national quality award criteria for performance excellence. (1998), (NIST publication No. T1077). Washington, DC: Author. (p. 43).

model seems to be more aligned with the traditional view of process management, as opposed to both Deming's Model (1994) and the Integrated Process Model (Zeleny, 1988).

The importance of the Baldrige Model is reflected in just how many people define TQM in terms of this model, as will be explored in Chapter 2. Since the definition of TQM is an important aspect of this study, the Baldrige System Model plays a role in management's perception of quality issues.

Brocato and Potocki (1998) found that they had difficulty in explaining the Baldrige System Model to engineers. They felt that, as a model of quality management, the Baldrige System Model was too confusing. Consequently, they revised it and created a quality management model of their own, one that is basically a closed system. Figure 7 on the next shows the input from "Measurements and Benchmarking" give "feed forward" to the output described as "Customer-focused improvements" (p. 192). From the output, they get feedback.

This model appears to the writer as mechanistic. It neglects the environment, such as customer and supplier, components that others felt are important (e.g. Deming, 1994; Spencer, 1994; Zeleny, 1988). Since the purpose of the Brocato and Potocki (1998) model is to teach

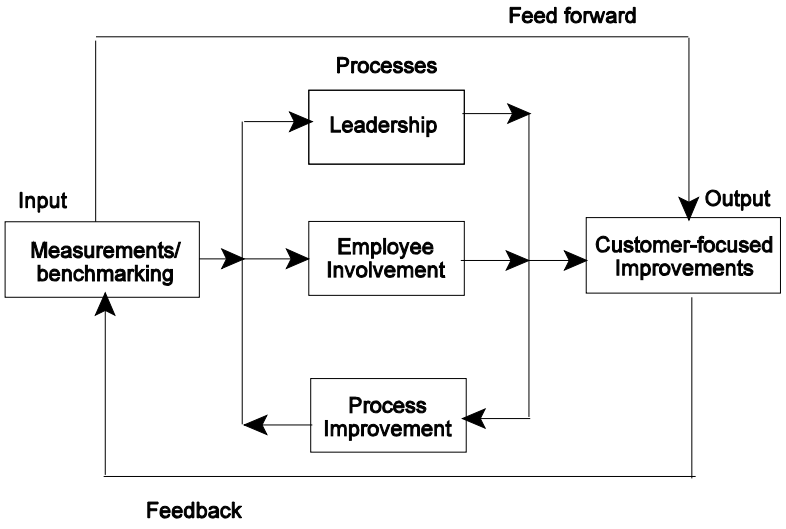

Figure 7 Brocato and Potocki's Revision of The Malcolm Baldrige Model. This revision was designed to teach engineers.

Source: Adopted from Brocato, R. and Potocki, K. (1998). A system model for quality management principles: Case study application to technical staff at a R&D organization. In ASQ (Ed.), 52nd Annual Quality Congress Proceedings: Milwaukee, WI: American Society for Quality. (p. 192).

engineers, this model is quite adequate for that purpose, but it is probably not sufficient as a general systems model of TQM. Even the original Baldrige Systems Model seems to consider the environmental components as being outside its purview.

The Need for Technology Versus Institutional Conformity

Berwick (1998) in discussing the diffusion of technology talks of five levels of adopters:

(1) Innovators (2.5%),

(2) Early Adopters (13.5%),

(3) Early Majority (34%),

(4) Late Majority (34%), and

(5) Laggards (16%).

He also cites Rogers concerning the Epidemiology of Adoption, “The part of the diffusion curve from about 10 percent to 20 percent adoption is the heart of the diffusion process. After that point, it is often impossible to stop the further diffusion of a new idea, even if one wished to do so” (cited in Berwick, 1998).

Berwick (1998, p. 4) describes innovators as having these characteristics, “Control of resources, high tolerance for uncertainty, gatekeeper for ideas, cosmopolite, cliques despite geographical separation.” To some extent, this describes Mr. William E. Conway, who, as president of Nashua Corporation, became convinced of the value of quality efforts. Conway relates how the application of quality principles recommended by Dr. Deming saved his firm $800,000 in their first effort at

applying them (cited in Deming, 1992).

Zbaracki (1997, p. 604) indicates that, “according to institutional argument, early adopters will pursue TQM for its technical merit and so will implement whatever works for them.” This seems to have been the case with Nashua Corporation, as TQM filled a technical need. Mr. Conway, an engineer by training, was a sufficient risk taker and had the necessary control of resources to adopt TQM.

Among the early adopters of TQM were such organizations as Pontiac Motor Division of GM, Ford Motor Company and the Department of Defense. The executives of these institutions were the ones who spearheaded the adoption of TQM. In the case of Ford Motor Company, Mr. Donald E. Petersen invited Mr. Conway in 1981 to a meeting with the Ford executives to discuss what we now call TQM (Scherkenbach, 1986). Mr. Petersen, also an engineer, adopted the method for Ford with good results.

Innovators and early adopters generally see the new concept as a way of solving technical problems. These two groups, Berwick (1998) indicates, are then followed by the early majority.

In the case of TQM, a problem appeared that seems to affect the diffusion of the method. This factor was related to the great variation of

what is meant by TQM. In fact, Deming himself was afraid of this effect. Zbaracki (1997) asserts that, “W. Edwards Deming (as quoted in Senge, 1992) claims that TQM is a vacuous term, mere hype that perverts his work.” While the writer could not find the quote in the journal referenced (Senge, 1992), it is probable that the report is true, since the writer was present at a meeting with Senge when Deming expressed this view (W. Edwards Deming, personal communication, 7 August 1992).

It is therefore not surprising to find that Zbaracki (1997) found that, “the history of TQM shows it shifting from its origins in a narrowly defined set of technical interventions (Dean & Bowen, 1994b) into an extraordinarily diffused fad, characterized by rhetorical excess and increasingly unclear definition (Hackman and Wageman, 1995).” The institutional conformity generally requires a fixed methodology or standard method to give legitimacy to adopting it.

The writer speculates that the appearance of the ISO 9000 series of standards represents the type of standard package that the later adopters are seeking. In a way, one could say that some recent methods, such as Benchmarking, Six Sigma Quality and Re-engineering, appear as standard packages, which makes them appealing to late adopters. The ISO 9000 series of standards probably has an edge over other systems in

that the European Community adopted this standard, thereby, lending it a governmental approval or legitimation.

Those early adopters that used Deming's theory were successful. With the creation of the term TQM, some confusion arose. Later adopters, looking for a package, searched what was available. Not being able to distinguish which package, if any, was useful to them they used what they considered best. Without applying theory, such a process creates confusion.

The later adopters are often influenced by the media. Kano (1993) sees this to be a danger. He says, "When I consider how American firms will develop TQM activities in the future, one influence is the mass media. It tends to discuss the short term effects of quality" (p. 29). He states further, "In addition, American consumers' [sic] tend to be uncritical of poor quality products and services" (p. 29). Kano (1993) maintains that until 1980, the Japanese Media paid little attention to the quality movement in Japan. While this allowed Japanese management to concentrate on long term perspective, it slowed down the diffusion of the movement in Japan. In spite of Professor Kano's opinion, it seems that the Japanese quality movement was more rapid than the American quality movement and more solidly founded.

Kano (1993) feels that the attention from the media caused a bandwagon effect. “There are some firms, however, that implement TQM simply because it is the fashion. So quality activities in such companies tend to be perfunctory or short sighted” (Kano, 1993, p. 29). In effect, they install *packages,* without understanding the *theory* involved. Deming stated, “Improvement of quality and productivity, to be successful in any company, must be a learning process, year by year, top management leading the whole company” (1992, p. 139).

A number of successful early adopters had a background in engineering or some numeric discipline. In banking, the two earliest applications were due to John S. Reed at First National City Bank (now Citibank) and Joseph Rice at Irving Trust. The management biographies of Citibank’s web site show that Mr. Reed holds a combined BA/B.S. from MIT and an MS from the Sloan School. Mr. John Morris of Citibank informed the writer that the Bachelor of Science is in Metallurgy and the Master of Science is in Industrial Engineering (private communication July 29, 1998). Mr. Rice, who is personally known to the writer, worked in the aerospace industry. Mr. Rice holds a bachelors degree in aeronautical engineering from Rensselaer Polytechnic Institute and a masters degree in industrial engineering and government from New York University. Both

of these men brought the manufacturing technology to the banking industry in the early 1970s.

With global competition, it is clear that the technology need that caused early adopters to look toward TQM still exists.

Quality concepts applied to the Service Industry

This section looks at the service industries in relation to quality concepts. There are a number of assumptions that appear in the literature. Among these are

(1) that service industries have embraced quality methods only recently;

(2) that they differ from manufacturing in the application of quality methods; and

(3) that they look at quality differently from manufacturing.

Are the Service Industries Newcomers to Quality?

In the 1990s, a number of writers implied that quality concepts in the service industry are new (e.g., Anonymous, 1994). For example, Schonberger (1992) stated: “TQM now cuts a broad swath. Success in the plant led to application of the same concepts in front and back offices.

This, in turn, raised awareness of TQM's capacity to kindle competitiveness, fueling an expansion into the service sector" (p. 16).

The simplest controls and tools to achieve quality had in fact, been used for centuries. Shewhart (1939), in a section on "Some Important Historical Stages in the Control of Quality", said "that as far back as 5000 years ago the Egyptians are supposed to have made and used interchangeable bows and arrows. . ." (p. 2). Juran (1983, p. J-17) uses in his logo a design showing an Egyptian mason and inspector. He states that this was "derived in part from a wall painting in a passage of the tomb of Rekh-mi-Rē, at Thebes c. 1450 B.C."

Like manufacturing, the service sector also had equivalent controls of quality. Latzko (1986) reports on controls exerted on bankers in the past. *Stelae* still exist from the kingdom of Eshunnana (circa 2000 B.C.E.), which detail rules for interest rates and remedies for failure to conform to the rates. These are simple governmental controls, like the images in Juran's logo. The Romans developed the concept of financial audits (Corns, 1968). The Byzantine Empire had a system of procedures that are not unlike the ISO 9000 series. Enforcement of these procedures were in the hands of officers of the court called "logothetes". In ISO 9000 terms one would call the logothete a "lead auditor". The Byzantine procedures

covered manufacturing, service industries, and governmental departments (Guerdan, 1956).

As methods to control quality became more sophisticated, they were used in service applications. One of the earliest modern applications in the service sector is reported by Deming and Geoffrey (1941), who applied the theory of process control to the 1940 population census. The writer asked Dr. Deming if this was his earliest paper dealing with quality in the service industries. Dr. Deming replied, “Actually, most of my papers deal with service industries” (personal communication, 8 June 1991).

The Quality Management Division and the Service Sector Division of the American Society for Quality were originally one unit, called the “Administrative Applications Division.” This group was founded in 1954, only ten years after the society itself was founded (Rosander, 1985). Early membership included people from airlines, telephone industry, insurance companies, and the like.

With rare exceptions, such as the work of Adam, Herschauer and Ruch (1978), *service industries* used methods developed for the *manufacturing sector*. Therefore, service industry companies have generally lagged a little in the adoption of new quality methods. However,

over the years, as new methods were developed, service firms adopted these. As mentioned, the work of Adam et al. (1978) resulted in a quality method developed *specifically* for the service sector.

How Different Are the Service Industries

Everyone agrees that service industries and manufacturing have differences. If these differences are understood, the application of methods leading to quality is quite straight forward. Latzko (1986) looks at the differences in terms of

- specification,
- product,
- measurement methods, and
- control.

MacDonald (1994) looks at the differences in terms of

- product,
- consumption,
- delivery,
- customer contact,
- customer involvement,
- consumption,
- financial impact,
- storage,
- transportability,
- customer perception, and
- complexity.

Additionally, McDonald (1994) also is concerned with the measurement method.

While differences do exist, understanding the theory of TQM allows for the easy adoption of the principles to service applications. Unfortunately, so many examples are given in terms of manufacturing applications, without extracting the theory, managers of service applications are often heard to say, “My business is different.” This is probably a good illustration of *cognitive opposition* (Reger et al., 1994). The successful applications in the service industries almost always are the result of applying theory to the situation.

Cognitive opposition is a basis for resistance to change. “According to personal construct (Kelly, 1955) and categorization theory (Lakoff, 1987), new ideas, such as total quality, are interpreted based on their similarities and *differences* with other, better known concepts.” (Reger et al., p. 571) (emphasis in the original.). When a new idea conflicts with the personal construct or schema of the organization, the rejection of the new theory for that reason is cognitive opposition to the new theory.

How Service Industries Look at Quality

Tamimi and Sebastianelli (1996) and their students surveyed

manufacturing and service industry executives. They used a questionnaire with two open ended questions and five definitions based on Garvin's eight dimensions of quality (Tamimi et al., 1996, p. 34). The researchers used a Chi-square analysis to look for differences between manufacturing and service industries. Although the sample method of using a convenience sample is indeed questionable, and the use of a non-parametric tool does not compensate for the possible bias in the sample, the average scores do give an indication of some possible differences between the two industries. Thus this writer does not feel as confident about the conclusions reached by the researchers as they themselves do. However, the author does feel that the question of a possible difference between manufacturing and service views of quality is worth further study.

Top Management's Role

One point on which there is more agreement than any other is that top management must take an active role for an organization to achieve top quality, to survive, and to be competitive. Juran (1995) says, "The most decisive element in the success or failure of improvement initiatives is the extent to which the CEO provides personal leadership" (p. 6). In fact, he devotes a whole chapter to this topic in his Quality Control

Handbook (Juran, 1988). In his book on quality planning, Juran says, “The upper managers must personally establish new directions and goals for the company and then personally lead the management team towards this goal” (Juran, 1988, p. 249). He gives prescriptions of how the top managers must lead their Company-Wide Quality Management (CWQM) (Juran, 1988).

Feigenbaum (1961) states, “Basic quality responsibility rests in the hands of company top management” (p. 43). Crosby (1979) labels step 1 of his 14 steps as “Management Commitment” (p. 132). His steps are divided into *action* and *accomplishment*. Under accomplishment, he explains that this step is “helping management to recognize that they must be personally committed to participating in the program . . . ” (Crosby, 1979, p. 132).

In his posthumous book, Deming (1994) puts it even more dramatically. He observed: “This book is for people living under the tyranny of the prevailing style of management. The huge long-range losses caused by this style of management have led us into decline” (p. xv). He also said, “The causes usually cited for the failure of a company are cost of start-up, overruns on costs, depreciation of excess inventory, competition—anything but the actual cause, pure and simple bad

management" (Deming, 1992, p. ix). Finally he said, "The job of management is inseparable from the welfare of the company" (Deming, 1992 p. x).

Mr. William Conway, then CEO of Nashua corporation, acknowledged,

> Many of the programs on statistics have died in America because they did not get top management support. . . . In the first six months, I would say in the program, I spent at least half of my time talking to people, writing memos, joining groups to try to convince them of the importance of the tool" (Crawford-Mason et al., 1980).

In discussing Quality Control Circles (QCC), Lawler et al. held that CEO's, on learning about the idea of Quality Control Circles from the media, "then ordered the personnel department to start a few to see how they work" (Lawler, III et al., 1985, p. 67). This is a very likely scenario, as evidenced by the writer's own experience. On publishing an article about Quality Control Circles (Latzko, 1981), the writer received about 50 calls from various personnel departments asking for details since their executives asked them to look into establishing QCC's, based on seeing the author's article..

As mentioned previously, Professor Kano (1993) commented about the influence of mass media on managers adopting methodology. It was

also stated that late adopters like packages. Lawler and Mohrman (1985, p. 66) indicate that the existence of packages is one of the attractions for firms to try QCC's. From their data, it appears possible that top management gets its information from the media and integrates it with their organizational need and culture to try new management ideas.

Choi and Behling (1997) studied a number of firms with an active TQM program. However, it was not clear how involved these firms were in the TQM process. Easton and Jarrell (1997) make the point that unless the process is well deployed throughout the organization and established for some period of time, the firm may not have in fact seriously established a TQM system. In common parlance, those interviewed talk a good game, in large part because it appears to be the thing to do. This is what Zbaracki (1997) refers to as "The Rhetoric and Reality of Total Quality Management."

Still, Choi and Behling (1997) found "a clear relation between the orientation of top managers and the likelihood that their firms would have an active TQM program" (p. 43). The orientation that they refer to is a taxonomy they created:

- developmental,
- tactical, and
- defensive (p. 40).

In effect, the developmental orientation consists of a management receptive to the TQM process. Such a management sees opportunities in the process. The tactical orientation is a management who see some benefit, principally in that the result will be pleasing to their customers. However, they do not see the process as adding *any* other value to their business. Lastly, managers with a defensive orientation undertake TQM solely to satisfy their customers (Choi & Behling, 1997).

Since the study (Choi & Behling, 1997) was undertaken from suppliers involved in making components for automobiles, the study concerned itself with companies that were under the gun from these manufacturers to follow certain systems, such as QS 9000 and other quality processes generated by the Automotive Industry Action Group (AIAG). This is a consortium of Chrysler, Ford and General Motors that provides quality standards and training. Given the single supplier policy that the automotive manufacturers use, there is a great deal of pressure for the supplier to provide satisfactory parts.

Statement of the Problem

Although modern methods of quality control have been known and

used since the 1920's, its application to management theory arguably dates to 1980 when the NBC white paper, “If Japan can . . .Why Can’t We?” (Crawford-Mason et al., 1980) appeared. In his Juran Institute Report, Jeremy Main (1998) attributes to this television show the rise in interest in the management for quality. “The NBC white paper of 1980,” he said, “had enormous influence on introducing Americans to the potential of total quality, and *Business Week*, *Fortune*, *Industry Week*, *Training*, and *USA Today* cover total quality with interest” (p. 309). Mrs. Killian (1992), in her biography of Deming, said that

> At least three major results came from the NBC White Paper. First, the audience realized that U.S. industry could do something to improve quality and productivity: the “easy excuses” of inflation and energy costs were, by themselves no longer valid. Then, American Industrialists who watched the program, not only grasped more fully the enormity of the problems they were facing, but they also realized that answers to their dilemma were available. Perhaps, most importantly, W. Edwards Deming was introduced to the audience as a man with effective answers. (p. 18)

Indeed, managers began researching the applications. As the first success stories appeared, more and more firms became interested in the application of what became known as Total Quality Management (TQM). Although the original use of the term TQM was to describe the Deming Method of managing for quality (S. L. Dockstader, personal

communication, 18 March 1998), the term rapidly took on a variety of meanings.

A variety of tools also appeared. Some, like Statistical Process Control and Acceptance Sampling, were from the 1920s period, while Benchmarking and Re-engineering are examples of more recent concepts. The wide variety of definitions of TQM and of the tools used caused organizations to select those tools with which they felt most comfortable. These choices seem to fit with organizational identity theory (Reger et al., 1994).

Reger, Gustafson, Demarie and Mullane (1994) discussed a dynamic reframing process to learn *why* and *how* organizations adopt TQM. By examining both the personal construct theory and the concept of cognitive opposition, they came up with propositions that allow optimal acceptance of the paradigm shift often required by an organization adopting TQM. They warn: “however, for most organizations, there are likely to be radical elements of TQM that framing alone will not make acceptable within the current organization identity” (Reger et al., 1994, p. 574).

If one deals with the choice of TQM tools used by organizations, one has two possible components or subproblems:

(1) top management's personal construct and

(2) whether the organization is in the manufacturing or service industry.

Since top management sets the organizational identity, the personal constructs of these managers can determine what tools to use. This is made possible since a choice of multiple tools exists and there is a large variation in the definition of TQM. The personal constructs of the managers may well be influenced by their background and training. It may also be influenced, as Kano (1993) thinks, by the media to which they are exposed.

There is also some evidence to point to a difference in organizational identity between service and manufacturing industries (Tamimi & Sebastianelli, 1996). These differences may lead to cognitive opposition to the use of certain methods in each of the two industries.

Hypotheses

The writer, therefore, poses the following hypotheses:

H1: The choice of tools is a function of the personal constructs of management; and

H2: The choice of tools is influenced by whether the organization

is in the service or manufacturing industry.

The literature search reported in the next chapter shows that there are many tools available. Some writers (e.g Wilcox et al., 1995) distinguish between *tools* and *techniques*. The present writer includes both tools and techniques, or methods, in the term “tool” as used in the hypotheses. The reason is that the distinction is often not clear and that frequently managers tend to think of these as one and the same. The list of “tools” is defined in chapter three.

Purpose of the Study

The study is designed to gain an insight into why managers choose particular tools for the quality improvement process. The particular tools that managers choose to use is also of interest. The study is also designed to determine whether the type of industry has an influence on the choice of tools for the quality process improvement. As Hackman and Wageman (1995) stated: “Research is not providing the corrective function for TQM that it could and should. There is plenty of room for additional learning, driven by research, on how TQM theory and practice could be improved.” (p. 339)

Spencer (1994, p. 467) suggests that: “by conducting interviews with TQM implementers, researchers may discern the rationale behind

members' choices as well as the values these choices entail." Following this guidance the writer looks at the choices to determine that rationale.

Importance of the Study

Wilcox, Dale, Boaden, and McQuater (1995, p. 1) note, "For many organizations that embark on a quality improvement process, the use of tools and techniques is the initial thrust of the approach." They continue by discussing problems that they observed which occur with the use of the tools. Among these problems they cite "a lack of understanding" of the tools, their use and application (Wilcox et al., 1995, p. 4).

Wilcox et al. (1995) explain:

> Tools and techniques rely on "critical success factors" to make their use and application effective. Some of these are
>
> - full management support and commitment.
> - effective, timely and planned training.
> - a need to use the tool or technique.
> - defined aims and objective for use.
> - a co-operative environment.
> - backup and support from Facilitators.
>
> When the critical success factors are in place, the use of tools and techniques provides a means to define the real issues, to identify the root causes, develop and test solutions and implement a

permanent solution. (p. 5).

By determining if the personal constructs of managers of the quality improvement process or their superiors influence the choice of tools, it may be practical to develop strategies to make the above “critical success factors” possible. This in turn would be a material benefit to the organizations involved. If the organizational identity of industry types has an influence, this might also lead to strategies for optimizing the tools available and that are suitable to the task.

Scope and Limitations of the Study

Since this study uses a multiple-case study method with a replicated design, it is dependent on the selection of the organizations involved and the researcher’s skill as an interviewer. These are limitations to any such study.

The number of organizations available that agree to be interviewed and are accessible to the researcher and fit the selection criteria are limited. Major commercial banks were chosen as being representative of the service industry. While banks fit the general description of a service industry, it is not certain that the banks chosen were more than indicative of all other service industries. This could be a distinct limitation of the

research.

The researcher has many years of experience in surveys and interviewing techniques. During the 1960s, the researcher was responsible for all market research activities of Columbia House, a mail order record company which, at the time, belonged to CBS/Columbia Records. During this time, the researcher developed and worked on hundreds of market research projects, supervising and performing field interviews. The researcher also has many years of experience in the application of quality in both manufacturing and services industries, particularly banking.

Nevertheless, there is always an opportunity for unconscious bias that can occur in the structuring of a research project. While every effort was made to avoid this bias, it is a limitation whenever a single researcher investigates a project.

There is also the possibility of bias on the part of the respondents. Conscious or unconscious factors may lead them to make the statements that they think the researcher wishes to hear. To avoid this limitation, the researcher asked cross check questions. For instance, questions concerning the deployment of the process and the length of time it has been established give a check on claims of the use of a process.

Wherever feasible, examples were sought.

A final limitation is the limited number of interviews to be held with the extensive need for organizing and analyzing large amounts of verbal data. Where applicable, content analysis is used to organize and classify the data. There is always the possibility of coding errors. These could be due to:

- the material itself,
- misjudging items,
- the researcher's bias, and
- simple errors.

Where content analysis is used, an independent coder is asked to code a sample of the work to validate the original coding. Standard acceptance sampling methods are applied.

Rationale for the Study

Reger, et al. (1994) make the point that, "establishing cognitive connections between core organizational identity constructs and new initiatives will increase the probability of members' acceptance of fundamental change" (p. 571). If one can determine how tools are chosen, it may make the dynamic reframing simpler and perhaps, even possible. This may overcome the problem that Dr. Frances C. Waters (1996)

discusses in her dissertation, ". . . that the current practice is to adopt portions of Deming piecemeal without espousing the foundational theory, so that the practices become merely cosmetic and superficial" (p. 190).

There is a good deal of evidence that application of a full-fledged TQM process pays great dividends for the company that undertakes it (Easton & Jarrell, 1997) . By understanding the cognitive opposition to various methods, we may be in a better position to move from rhetoric to reality (Zbaracki, 1997).

Definition of Terms

The following are definitions of some key terms used in this dissertation:

1. **Acceptance Sampling**: The use of statistical sampling of a lot of items to determine if they are acceptable for use.
2. **AIAG**: see Automotive Industry Action Group
3. **American Society for Quality (ASQ)**: Formed in 1946 this organization is concerned with issues of quality.
4. **ASQ**: see American Society for Quality
5. **Automotive Industry Action Group (AIAG)**: This is a consortium of Chrysler, Ford, and General Motors to promote quality of automotive products.

6. **Back Office**: A term (often derogatory) used for the processing aspect of an organization that usually does not come in direct contact with the customer.
7. **Benchmarking**: A method of learning and adopting the best practices of organizations known for their use of these “World-Class” methods.
8. **Chi-square Analysis**: “Tests of the difference between several sets of proportions (p x m contingency table)” (Quenouille, 1959) This tests the hypothesis that the observed values came from the same population. The test is not dependent on any underlying distribution or parameter.
9. **Cognitive Opposition**: The theory is that the organization’s identity is made up of core constructs which contain a positive and negative element. Reger, et al. gives the example of low cost versus differentiation. The construct of low cost may be considered positive by an organization. A theory which challenges this organizational identity is “likely to trigger negative affective responses” (Reger et al., 1994). This affect is considered cognitive opposition.
10. **Cognitive Connections**: Seeing the positive linkage between

beliefs people hold and a new set of ideas (e.g. Deming's System of Profound Knowledge™) needed to make total quality management a part of the belief system.

11. **Company-Wide Quality Control (CWQC)**: A term used mainly by the Japanese to described the deployment of quality concepts. It is often used in the same way as TQM or TQC.

12. **Control Chart**: A control chart is a plot over time of the result of small samples. In addition to the plotted values it contains three reference lines: the center line (usually the average) and the Upper and Lower Control Limits. These limits are obtained from the data. There are several types of charts, including the Shewhart Chart, Cumulative Sum Chart, Exponential Weighted Mean Chart, etc. Deming considered only the Shewhart Chart as useable in process management. The reason is that the Shewhart Chart is an operational definition of a special cause of variation.

13. **Cross-functional Management**: As used here, it refers to Tachiki's (1990, p. 12) matrix showing the functional responsibility of each division such as administration, marketing, etc. The divisions are listed as column heads and the functions are listed on the rows. Where responsibility exists, the cell for the appropriate

row/column intersection is marked.

14. **CWQC**: see Company-wide Quality Control

15. **Deming Wheel**: See Shewhart Cycle

16. **Deming Prize**: An award given in Japan to companies and individuals. Any company, even foreign firms, that show that they meet the criteria are eligible for the prize. The Florida Power and Light Company was a winner of the Deming Prize.

17. **Deming's 14 Points**: A list of 14 prescriptions that Deming considered essential to become and remain competitive. The list based on Latzko and Saunders's book, *Four Days with Dr. Deming* (1995) follows:

    1. Create constancy of purpose.
    2. Adopt the new philosophy.
    3. Cease dependence on mass inspection.
    4. End the practice of awarding business on the basis of price tag alone—Instead reduce cost by reducing variation.
    5. Continual improvement.
    6. Institute training for a skill.
    7. Adopt and institute leadership.
    8. Drive out fear.
    9. Break down barriers between staff areas.
    10. Eliminate slogans, exhortations, and arbitrary targets.
    11. (a) Eliminate numerical quotas for the work force. (b) Eliminate numerical goals for people in management.
    12. (a) Remove barriers to pride of workmanship. (b) Drop the annual merit review.
    13. Encourage education and growth

14. Take action to accomplish the transformation

18. **Design of Experiments**: A method to use statistics to determine which set of conditions is optimum. The methodology probably grew out of Sir Ronald Fisher's work with improving agricultural yields in England.

19. **Diffusion of Technology**: How new ideas flow through society and become adopted or rejected.

20. **Dynamic Reframing Process**: A model proposed by Reger, et al. to show how new concepts can be adopted into the organization's culture. In effect the reframing means a change in belief held by an organization.

21. **Feed Forward**: Information flow or connection of ideas from the point of origin to the points further along.

22. **Feedback**: Information flow from a point beyond the origin to the origin.

23. **Flow Diagram**: A term used by Deming to describe his process model.

24. **Input-Output Model**: A model that shows the flow from the beginning of a process to the end of the process. In the case of manufacturing a common model is input of resources from

suppliers, conversion of the resources to a product, and output of the product to customers.

25. **Integrated Process Management Model (IPM)**: A model proposed by the Fordham faculty and described by Zeleny (1988) that modifies the Input-Output model to actively include the environment as well as the conversion process.

26. **IPM**: see Integrated Process Management Model

27. **ISO 9000**: A set of standards of the International Standards Organization (ISO) outlining a system to assure quality. In theory, suppliers who are qualified under this system, supply acceptable product to the user. There is a debate whether this is, in fact, the case.

28. **JUSE**: see Union of Japanese Scientist and Engineers

29. **Malcolm Baldrige National Quality Award (MBNQA)**: This award for U.S. firms was created by Congress to encourage companies to improve their quality. Named after Malcolm Baldrige, Reagan's Secretary of Commerce, the award has seven main criteria:

    (1) Leadership,
    (2) Strategic Planning,
    (3) Customer and Market Focus,
    (4) Information and Analysis,
    (5) Human Resources,

(6) Process Management, and
(7) Business Results.

These are further subdivided. The award is limited to two firms in service industry, two firms in small business (less than 500 employees) and two firms in manufacturing. Currently awards for health care and education are in progress.

30. **Managing by Policy**: This is a method of focusing on the process rather than on outcomes. Essentially, managers agree on a method of achieving specific results. When results fall short of the plan, the senior management reviews it to see if the method was followed. If not, they must determine the reason for not following it and make whatever decisions are required to get back on track. However, if the method was followed, the senior management must decide on the next steps to get back to the plan.

31. **Manufacturing Industry**: The sector of the economy that produces physical goods or products.

32. **MBNQA**: see Malcolm Baldrige National Quality Award

33. **Mechanistic Model**: A model such as the Input-Output model above that does not take the environment into consideration. The concentration in such a model is on improving the conversion

process.

34. **Military Standard**: A group of standards issued by the Department of Defense (DoD). These standards apply to all activities of the DoD. In purchasing materials or logistics from outside suppliers, these standards also apply to the supplier.

35. **Multivariate Analysis**: A class of statistical analyses dealing with multiple variables or unknowns. Some of these techniques are regression analysis, factor analysis, Discriminant analysis, etc. In each case, one or more variables have an impact on the outcome. A simple example might be forecasting, where several factors influence the outcome.

36. **National Institute of Standards and Technology (NIST)**: The organization charged with the supervision of the Malcolm Baldrige National Quality Award. Formerly the National Bureau of Standards, their function was expanded to look after technology.

37. **NIST**: see National Institute of Standards and Technology

38. **Non-parametric**: A statistical method that does not depend on a given underlying distribution. Parametric methods often have assumptions about the distribution which, if not met, make the result unreliable. Non-parametric methods do not have this

constraint.

39. **Operations Research (OR)**: The methodology employing a class of techniques that solve operational problems. Started during World War II to apply scientific principles to increase the amount of shipping reaching Europe, this method is employed in many industries. Among the methods are things such as mathematical modeling, queuing theory, etc. Today, many of these methods today are taught in courses of operations management.

40. **OR**: see Operations Research

41. **Organismic Model**: A model that considers all factors such as the environment in which it operates. The goal of this model is organizational survival and is concerned with customer satisfaction. This model includes environmental factors in its boundaries, has a vision, with management control to see the vision is accomplished, enjoys active employee participation, and is willing to change and adapt itself to new ideas (Spencer, 1994).

42. **Organization Identity**: This refers to the belief and value system of an organization.

43. **P-D-S-A**: see Plan, Do, Study, and Act

44. **Personal Construct**: This refers to the personal belief or value

system of those within the organization. These values are often conditioned by the organization identity.

45. **Plan, Do, Study, and Act (P-D-S-A)**: This is also called the Shewhart Cycle of Learning. It is a method to work on continual improvement. The part that is most often done poorly is the planning part. The word “control” was used initially instead of “study.” The connotation, however is different. Control implies a binary system of good or not good. It implies that other alternatives are rejected. The word “study’ allows many more alternatives and alternative actions.

46. **Policy Deployment**: The use of management by policy throughout the organization. This means that the whole organization sees itself as striving for a common aim via process controls, rather than having outcome orientation.

47. **Pyramid of Quality**: Tachiki’s (1990) concept of the 10 building blocks of Japan’s system of quality.

48. **QC Circles (QCC)**: A group of employees who work on problems arising from the process. These employees must be trained in a number of methods to be successful.

49. **QCA**: see Quality Control Audit

50. **QCC**: see QC Circles

51. **QFD**: see Quality Function Deployment

52. **QS 9000**: A standard which adapts ISO 9000 standard to the automotive industry. Certain aspects of QS 9000 go beyond the ISO 9000 Standard.

53. **Quality Circles**: Quality Control Circles are commonly called “Quality Circles” in the United States.

54. **Quality Control Audit (QCA)**: A method of verifying that standards, plans, and policies are followed and are effective.

55. **Quality Function Deployment (QFD)**: Sometimes called the “House of Quality”, this is a method using a multi-functional team to design new products or re-design existing products. Using a matrix method, the team compares customers’ needs with competitive products and develops a plan to meet these needs. One advantage of the matrix method is that solution conflicts are easily seen and resolved early in the design process (King, 1987a).

56. **Quality**[1]: Kemper’s (1997) definition of Dr. Deming’s quality process.

57. **Re-engineering**: A process of starting the process design from scratch. Hammer and Champy (1993), who popularized the method

at one time went to considerable pains to distinguish this method from TQM. However, not everyone agrees with that view.

58. **Sample Theory**: The theory that deals with the statistics and other issues such as bias in using a portion of a list to estimate the behavior or outcome of the whole list.

59. **Service Industry**: That part of the economy that performs services for others. Usually, the service is intangible.

60. **Seven New Tools**: This is also called the “Seven Tools of Management.” The tools are,

    (1) Affinity or KJ diagram,
    (2) Interrelationship Digraph,
    (3) System Flow or Tree Diagram,
    (4) Matrix Diagram,
    (5) Matrix Data Analysis,
    (6) Process Design Program Chart (PDPC), and
    (7) Arrow Diagram (King, 1987b).

61. **Seven Tools of Quality (Ishikawa)**: Ishikawa (1985) called these, “Elementary Statistical Methods:”

    (1) Pareto Chart,
    (2) Cause and Effect diagram (sometimes called Ishikawa or Fishbone Diagram),
    (3) Stratification,
    (4) Check Sheet,
    (5) Histogram,
    (6) Scatter Diagram,
    (7) Graph and Control Chart. (P. 198)

62. **Shewhart Control Chart**: A control chart whose limits are plus or minus three standard deviations from the center line. This chart is an operational definition of a special cause.

63. **Shewhart Cycle of Learning**: see P-D-S-A.

64. **Shewhart Cycle**: A cycle that Deming originally introduced to the Japanese in 1950. It starts with design, goes to making, then selling, followed by testing in service, and finally, re-design (Deming, 1951).

65. **Six Sigma Quality**: A concept initiated by Motorola to improve quality. The concept is based on the possibility of a one and one-half sigma shift of the process. To avoid a serious problem in such a situation, Motorola recommends the use of six sigma limits for processes rather than Shewhart's three sigma. Although the writer and others have severe theoretical reservations about the reasoning associated with the statistics, continual improvement initiatives using this concept have often yielded outstanding results.

66. **SPC**: see Statistical Process Control

67. **Statistical Process Control (SPC)**: The use of Shewhart Control Charts to control and improve the process.

68. **System of Profound Knowledge**: A system of four elements,

including:

(1) understanding of systems,
(2) understanding of variation,
(3) understanding of the theory of knowledge, and
(4) an understanding of psychology.

69. **Total Quality Control (TQC)**: The Japanese term for the achieving quality throughout the organization. The term was originally coined by Feigenbaum (1961) as it was the title of his book . The Japanese insist that their term, TQC, is more inclusive than Feigenbaum's use of the term. (Kano, 1993).

70. **Total Quality (TQ)**: The term Dean and Bowen (1994a) used because they were dissatisfied with the term Total Quality Management.

71. **Total Quality Management (TQM)**: A term that has come to mean a number of things. In general, it refers to a system which helps manager achieve quality, productivity and competitive position.

72. **TQ**: see Total Quality

73. **TQC**: see Total Quality Control

74. **TQM**: see Total Quality Management

75. **Union of Japanese Scientist and Engineers (JUSE)**: The organization that was formed after World War II. They invited W.

Edwards Deming to lecture on quality control. They established and administer the Deming Prize. Their telegraphic acronym is JUSE, and they are also known by that name.

Overview of the Study

The aim of this research is to learn if the selection of tools for TQM are dependent on the managers background and/or the type of industry that is involved. From this data, strategies for the effective implementation of tools for managing for quality are recommended.

The qualitative method used to obtain the data is a multi-case embedded design. By embedded design, it is meant that multiple units are studied within each case. Banks were chosen to represent the service industry. Local manufacturers were used to represent manufacturing. For both the banks and manufacturers, interviews were conducted in more than one department. For each of these organizations, interviews were set up with decision makers. Corroborating details were obtained, where feasible, for claims made in the interviews.

The results of the interviews and other data collected were used as the base for analysis to obtain findings. From these findings, conclusions were drawn, strategies were suggested where possible, and areas of further research were noted as they occurred.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Overview

Total Quality Management and its acronym, “TQM”, has become a widely used term related to managing for quality. This chapter examines the literature related to the term TQM, associated tools and benefits.

Aim of this Chapter

In order to develop the research related to the hypotheses in the first chapter, three areas of the literature are examined. First, the writer looks at what is meant by TQM, and the consequences of what turned out to be a divergence of opinion. Secondly, the writer reviewed the literature for what are considered to be the tools of TQM. In line with this review, a search was made for a common taxonomy or typology that was uniformly accepted. Thirdly, the writer reviewed the literature to find whether there are documented benefits to using TQM.

Methods Used

The initial search of ABI/Inform using the search criteria of “TQM.” This yielded 2190 citations. These citations were imported into Reference Manager 8.5 for further search and analysis. From the master list,

searches were conducted for “definition of TQM”, “tools”, and “Benefits, Profitability, Costs, and Problems.”

Wherever, the abstract indicated possibility of fitting into the research, the article was reviewed. In a number of cases, articles had to be requested from other libraries. In a few instances, the journal was so new that it was either not readily available in the accessible libraries (e.g. Quality Management Journal) or it was a difficult to obtain foreign publication.

During this search, two academic journals, the Spring 1993 issue of the California Management Review and the July 1994 issue of the Academy of Management Review, and one trade journal, the July 1995 Quality Progress, were found to have had issues devoted entirely to TQM. As TQM became more popular, especially in Great Britain, journals devoted entirely to TQM appeared on the scene. Two journals published in England, Total Quality Management and TQM Magazine, were particularly difficult to obtain. The former publication is more of a trade journal, while the latter is more academically oriented.

Many of the papers in academic journals referenced other relevant papers. Using Kemper’s method (1997) of following leads, the relevant papers were also reviewed and incorporated in the research whenever they were found to be applicable. In some cases, working papers were

referenced. These could frequently be obtained from the authors.

In searching for papers referenced in journal articles, the UMI ProQuest Direct was accessed via the Internet. Frequently, papers were available in Adobe's Portable Document Format (PDF) and could be read directly. At other times the full text was accessible via Hypertext Markup Language (HTML), and the document could be read in that fashion. The HTML files often did not contain the tables and figures of the original article. Since these illustrations frequently were very important to the meaning of the paper, articles of this type were researched wherever possible, found in bound copies or microfilm in libraries.

In addition to the journal articles, the writer searched the catalog (CATNYP) of the New York City Science, Industry and Business Library (SIBL) under the subject of "Total Quality Management." There were 188 items listed. The most promising of these were scanned for the three characteristics of definition of TQM, the tools and their taxonomy, and the benefits of using TQM.

The writer also contacted the Deming Electronic Network (DEN) on the Internet, inquiring about the three characteristics. Indeed, some responses were received. The writer also found what is probably the origins of the term TQM and what was meant by the term originally.

Origins of TQM and its Definition

The management for quality has many names. It has been called, among other things:

- Quality Control (QC) (Shewhart, 1931),
- Total Quality Control (TQC) (Feigenbaum, 1961; Ishikawa, 1991),
- Corporate Wide Quality Control (CWQC) (Tachiki, 1990),
- Total Quality Management (TQM),
- Total Quality Leadership (TQL) (Houston & Dockstader, 1996),
- Total Quality (TQ) (Dean & Bowen, 1994a),
- Quality[1] (Kemper, 1997),
- Poka-yoke (mistake-proofing) System (Shingo, 1986)

However, the most common name used for this method today in the United States is Total Quality Management (TQM).

This section will trace the development of the name TQM and trace some of the consequences associated with using this name.

Quality Control

Today managing for quality is most commonly called Total Quality

Management or TQM. However, it started out as a process, invented by Dr. Walter A. Shewhart, (1931), called Quality Control (QC). An interesting misconception grew up over the years as to the meaning of the word "control" in this context. It originally did not mean "to exercise restraint or direction [over a process]" (The Random House College Dictionary, 1975). Shewhart (1931) defined it as,

> For our present purpose a *phenomenon will be said to be controlled when, through the use of past experience, we can predict, at least within limits, how the phenomenon may be expected to vary in the future. Here it is understood that prediction within limits means that we can state, at least approximately, the probability that the observed phenomenon will fall within the given limits.* (p. 6)

Quality Control (QC), as Shewhart saw it, is the ability to predict that a process will continue at its present level of performance. QC is thus *process* oriented, not *product* oriented. That means, if the process gives a predictable level of output, the product will be at that level of quality. Alternatively, if the output level is satisfactory, no costly inspection is needed. If the process does not yield a satisfactory level of quality, either a fundamental change in the process is needed or the output requires 100 % inspection (see chapter 15, Deming, 1992).

The idea of Quality Control incorporates more than a simple statistical measurement as the mechanical models of quality indicate. When one looks at QC as an organismic model, it is the basis for a whole

philosophy of running an organization for maximum productivity at minimum cost. Latzko and Saunders (1995, p. 47) show the impact of quality on productivity. The increase in quality increases output while reducing input. As a result, productivity grows at a very rapid rate. They were illustrating “Deming’s Chain Reaction,” which says that if one improves quality productivity increases making it possible to “capture markets with better quality and lower price” to “stay in business”, “provide jobs and more job” (Deming, 1992, p. 3).

Although Shewhart looked at Quality Control as a method that considers the environment, other early writers on the subject of QC looked at this topic as a means to an end. Authors of early texts of quality such as Grant (1964), Duncan (1974), Cowden (1957), and Western Electric’s Statistical Quality Control Handbook (1956) discussed the use of Control Charts, but not what is meant by “control.” In the process, it may be that later students using these texts learned the mechanistic view of the term “control” rather than the original organismic notion of Shewhart.

Other writers such as Juran and Gryna (1980) define “control as used in this book refers to the process we employ in order to meet standards” (p. 3). In his book, Managerial Breakthrough, Juran (1964) devotes an entire chapter to control. He defines control as “staying on course, adhering to standards, prevention of change” (p. 181). With

Juran's many contributions and importance in the field of Quality Control, his definition has prevailed over Shewhart's.

Semantic differences are important because users get a different impression, based on the semantics. Unless they go back to the original source, they will learn the latest version. Thus, the word "control", in the arena Quality Control and Statistical Process Control (SPC), has come to mean regulation not prediction. The American Society for Quality (ASQ) dropped the world "control" from its name because of this change in meaning. Unfortunately, by changing the semantics, the underlying holistic concept of Shewhart is lost. Other terms are now needed to convey the same idea. The result is that today, we favor TQM as a way to express what we mean when we try to describe managing for quality.

Total Quality Control

While Feigenbaum (1961) defines control as so many people today define it, he originated the words "Total Quality Control", or TQC. His definition states that:

> … total quality control is an effective system for integrating the quality-development, quality-maintenance, and quality-improvement efforts of the various groups in an organization so as to enable production and service at the most economical levels which allow for full customer satisfaction (p. 12).

In Feigenbaum's (1961, p. 16) view, TQC focuses on the "8 stages of the industrial cycle" to a common aim to obtain quality. He shows how *every activity* concerned with the making of a product must coordinate to achieve the desired quality. Starting with marketing and, implied, with market research, he states, "Marketing evaluates the level of quality which customers want and for which they are willing to pay" (p.16). This information is then used by the other departments to fulfill marketing's objectives.

Feigenbaum (1961, pp. 83 - 102) is an advocate of the so-called "Cost of Quality" school that holds that there are four costs associated with quality:

(1) *appraisal or checking* that the product meets specifications,

(2) *Internal failure*, the costs associated with rework if the appraisal finds defective items,

(3) *external failure*, the costs associated with customers receiving defective product, and

(4) *prevention*, the cost of avoiding failure in the first place.

The sum of all of these costs is called "total quality cost."

He advocates the optimization of the quality costs by ". . . balancing of preventative and appraisal costs against failure costs" (Feigenbaum, 1961, pp. 133 -134). This assumes that the process is operating at a

given level of quality and that increased prevention and appraisal costs reduces the failure costs.

There are several objections to Feigenbaum's concept. First, the four costs that are described represent only the measurable internal costs. Second, the model assumes a static process, delivering a given level of quality that can only be changed by changes in prevention and appraisal. There is also a built-in assumption that there is a *known* smooth relationship between the failure costs and the others. In fact, increase in appraisal often results in discontinuous relationships, this is because increased manpower often requires increased supervision. Third, the total cost is usually a second order curve with a minimum. Optimizing such a curve would mean that if one were on the right of the minimum, one should make some bad product in order to get back down to the minimum. Such a policy seems strange in today's world.

There are in fact two other costs involved that are known to exist but are not readily measured. These are

(1) the cost of the customer who receives less than satisfactory product, and

(2) the cost of the employees who have to struggle with less than satisfactory material presented to them for work.

Additionally, if one considers an organismic model of quality, the

cost of the supplier may be added. This represents the cost of buying on price tag alone, without considering the long term cost of the product in use.

The undocumented costs may well be several times larger than the documented costs. The writer has the experience of saving a net of $40,000 by reducing appraisal in a small department with high quality output and losing a $2,000,000 account. What would have been considered as excess quality cost resulted in a level that the customer wanted. By reducing that level, the customer became dissatisfied and left.

Feigenbaum's use of Total Quality Control is limited to the product and uses the cost of quality philosophy as an integral part of the TQC. Both Professor Kano (1993) and his teacher, Professor Ishikawa (1991), differentiate Japanese TQC from Feigenbaum's version. Kano (1993, p. 15) holds that "'TQM' is called 'TQC" in Japan, although its activities can be better explained by TQM (Total Quality Management) than by TQC (Total Quality Control). This is because both 'management' and 'control' are foreign terms for the Japanese, who understand them as synonymous."

Professor Ishikawa (1991, p. 199) is more detailed when he states:

> The total quality control practice as we understand it in Japan is different from the generally accepted concept of TQC triggered by Dr. A. V. Feigenbaum. In our concept of

> TQC each and all people in the organization hierarchy in the range from the top managers down to workers at the rank-and-file level have exposure to statistical quality control knowledge and jointly participate in the upgrading of company-wide quality control practice.

The term “Company Wide Quality Control” (CWQC) is also used by the Japanese interchangeably with TQC. Ricoh (1982) in a pamphlet describing their path to getting the Deming Prize, states:

> Originally restricted to the areas of technology, manufacturing, and inspection at the time of their introduction to Japan, quality control activities have grown in importance and have found broader applications. With the development of “company-wide quality control” programs, these activities have spread to ‘non-production’ departments like business, clerical, planning and controlling.
>
> In Japan today, company-wide quality control is promoted by all members of the firm—top executives, managerial staff, engineers and line workers—who do their jobs with a clear understanding of their relationship to other members of the organization, and other departments. (p. 3)

The brochure is an interesting example of how successful Quality Control Circles function in Japan. In addition to what we see in the United States, several applications of control charts and other statistical tools were used by the workers. The Ricoh (1982) Pamphlet describes three Quality Control Circle case studies. In the first case, “Shortening customers’ telephone waiting time”, They used Cause and Effect diagrams, check sheets, and Pareto diagrams (p. 9 - 10). In the second case study, “Conserving adhesive tape for use in packing copier paper”

the teams used histograms and pictograms (p. 11 - 13). In the third case study, The reduction of resin output variation in Reaction Tank A", the teams used flow charts, run charts, histograms, cause and effect diagrams, check sheets, scatter diagrams and control charts (p. 13 - 17).

The term TQC or CWQC in Japan implies the use of the tools taught to the Japanese by Drs. Deming, Ishikawa, and Juran. Hackman and Wageman (1995) use these three quality pioneers to build up their concept of TQM. In general, it appears that there is a *substantial* convergence in theory and method between Japanese TQC and the original meaning of TQM. This writer learned that this was not at all accidental.

Total Quality Management

The writer was able to locate only two references to Total Quality Management (TQM) prior to 1985. Both were published in 1984.

One of these articles (Anonymous, 1984) reports on a "Total Quality Management System" (TQMS) developed by the Allen-Bradley Company. The article states that, "the three-part program deals with quality, reliability and safety, and is based on practical economics and return on investment" (p. 44). The use of TQMS is more in line with Feigenbaum's notion of TQC in comparison to the more deployed

Japanese view.

The other article by Rehder and Ralston (1984) relates TQM to TQC much as we do today. The authors use a hybrid definition as they state on p. 27 of their article:

> The most used term in Japan to describe its quality system is total quality control (TQC). However, in the United States the word “control” frequently carries negative connotations, and the word “management” is often substituted. Therefore, in this paper we have chosen to use the term total quality control/ management (TQC/M) to describe this hybrid Japanese/American system that has taken over 30 years to develop.

While this seems to be the earliest reference to Total Quality Management (TQM), as we know it today, it seems to have had little impact, for the writer could find no other references to TQC/M. Some searching disclosed that the *real* use of the term originated with the military, who adopted it as a way of describing the Deming Method of managing for quality (S. Dockstader, personal communication, 18 March 1998). Dr. Dockstader responded to the writer’s request to the Department of Navy Total Quality Leadership Office. His full reply, and another response to Professor Kelada of the HEC Business School University of Montreal, with some additional details, is reproduced in Appendix A of this study.

In 1984, Dr. Dockstader was asked to come up with a name that

the Naval Aviation Logistics Command (NALC) could use to describe their new approach to quality. He originally suggested the term TQC, as used by Dr. Ishikawa. However, he found, as Rehder and Ralston (1984) suggested above, that

> The NALC commander [Admiral John Kirkpatrick] and his staff were not comfortable with Dr. Ishikawa's elaborate description of TQC, and the Commander, in particular, did not like the word "Control." He suggested that we develop something more consistent with the Deming philosophy--which he felt was the approach he wanted to pursue. Given that suggestion, I developed the definition based upon my understanding of Dr. Deming's flow diagram "Production viewed as a system. (Deming, 1986, p. 4)." I consider that diagram as seminal to quality management and have always been proud of the fact that TQM was defined by some of the thinking stimulated by it.

He goes on to relate that “a member of his [Admiral Kirkpatrick’s] staff, Ms. Nancy Warren, suggested the world ‘management’ instead. Her actual words were: ‘Deming is talking about management, why don't we call it “Total Quality Management”?’” This was accepted, and the term was adopted by the Department of Defense. Dr. Dockstader indicated that at the time, they did an extensive literature review and found no other use of the term TQM. In a report issued by the Department of Navy Total Quality Leadership Office, Houston and Dockstader (1996, p. 11) indicate that they started the research in the Spring of 1984, not the Fall as Dr.

Dockstader stated in his e-mail to the writer. That would account for the fact that they found no other reference to TQM at the time.

Dr. Dockstader (personal communication, 18 March 1998) also explained that, “TQM was re-named TQL in 1991 when the military head of the Navy, [Admiral] Frank Kelso, commented that naval ‘warriors’ did not like to be regarded as ‘managers.’” However, the definition of TQM/TQL did not change, other that the substitution of the word “end-user” for the word “customer.”

Houston and Dockstader (1996, p. 12) define TQM/TQL as

> the application of quantitative methods and the knowledge of people to assess and improve (a) materials and services supplied to the organization, (b) all significant processes within the organization, and (c) meeting the needs of the end-user, now and in the future.

They also state on the same that, “the Deming philosophy provides the basis for TQL.”

In its origins then, it appears that the term TQM was developed by the Navy to represent the approach that the Japanese call TQC. It is also clear that TQM was based on the Deming philosophy. As further literature search suggests below, the term has undergone a transformation, akin to Rule Four of the Funnel Experiment (Deming, 1994, p. 194). Rule Four is like the game of “telephone”, where one person tell another some story, which is then repeated by succeeding people. At the end, the resulting

story bears little, if any, relation to the initial tale.

Views of TQM

The phrase “Total Quality Management”, and its acronym “TQM”, has become one of the most commonly used ways to describe a variety of activities and theories related to the quality of products and services. Many people, (e.g. Rhodes, 1992, p. 76; Goldberg, 1993, p. 53; Hartman, 1997, p. 338; Anschutz, 1995, p. 15; Anonymous. 1998, p. S2), ascribe this term to Dr. W. Edwards Deming who, however, insisted that he had *nothing* to do with it.

Nevertheless, the association persists in the literature. Hartman (1997), for instance, thought that “Total Quality Management evolved from W. Edwards Deming's 14 points, which was termed Total Quality Control.” Goldberg (1993) attributed the “theoretical constructs” of TQM to Deming and Juran, while Rhodes (1992, p. 76) attributes TQM to Deming and others, stating: “It’s becoming clearer to me that the power of Total Quality Management concepts of Deming and others derives (1) from their psychological and value-driven base, and (2) from their ‘totalness’[sic].”

Shoop (1991, p. 17) wrote that “the Defense Department started TQM in the mid-1980's and adopted it as official department policy in 1988 (DoD now even has a deputy undersecretary for TQM)….” The final

draft of DoD Total Quality Management Guide states that: “TQM is based on the well articulated concepts pioneered by such visionaries as Deming, Juran, and Feigenbaum ….”(U.S. Department of Defense et al., 1989) This sentence may have contributed to the confusion of Deming’s association with TQM.

In the ten years since the adoption of TQM as a policy by the Department of Defense, many articles and books have appeared on this subject. It is interesting to note that the term TQM is being taken for granted in much of the literature. In fact, many articles and books that use the term “TQM” do not define what they mean by the term (e.g. Akers et al., 1991; Forbes, 1992; Fowlkes and Creveling, 1995; Heathy and Gruska, 1995; Hendricks and Singhal, 1997; Lawler, Mohrman, and Ledford, 1992; Marcus, 1998; Ramaswamy, 1996; Tenner and DeToro, 1997) .

There are some writers, who like Deming, do not use the term TQM. Writers like Landes (1995) have the same objection to the term that concerned Deming. He writes: “ We believe that the term total quality management (TQM) along with similar concepts and phrases, actually hindered the progress of our improvement efforts, so today we have no definition for TQM” (p. 44). Landes (1995) indicated that while he wrote the sentence cited above, the management and people at Wainwright

Industries (the subject of the article) concurred with his statement (Landes, private communication, 22 January 1998).

Since they are not comfortable with the term TQM, other writers use alternative terms. For instance, Kemper (1997), in his great meta-literature analysis, distinguishes among three primary notions:

- Quality[1] (Quality with a superscript 1),
- Total Quality Control (TQC), and
- TQM.

He created the term Quality[1] to distinguish works "by, about, and based on the works of W. Edwards Deming and a number of his followers" (Kemper, 1997, p. ix). He also lists a series of separate categories, such as Quality Function Deployment (QFD), Benchmarking, Re-engineering, etc. These categories are sometimes considered a subset of TQM and at other times as independent methods (Kempper, 1997)..

Dean & Bowen (1994) drop the "M" from TQM simply call it TQ. They found that writers use TQ as "a hazy ambiguous concept." In fact, part of their article is devoted to putting the concept on a formal footing. The other part deals with an examination of the Malcolm Baldrige National Quality Award traits and management theory.

Deming feared that the label "TQM" would lead to misunderstanding, misapplication and misuse of the management

concepts for quality. In fact, Dr. W. E. Deming (personal communication, July 8, 1992) felt that the term TQM implies that quality is a *method* when in reality it is the *outcome of a method*. Deming was particularly upset when, at seminars, questioners identified him as the father of TQM. His concern was that TQM would be seen as an *independent variable*, a method. He feared that managers would look upon TQM as a tool kit, something to be installed by a craftsman to make all those quality problems go away.

Deming often expressed his disdain for those who think that one can *install* quality control (Deming, 1992, p. 138). TQM, he felt, comes close to being a *package*. If later adopters look for packages to install, as Lawler and Mohrman (1985, p. 66) indicate, then TQM will appeal to them, even if they do not understand the nature of the package. Yet, how could they know the value of a package if they have no theory? As a result, changes in the meaning of TQM can indeed take place over time. Hackman and Wageman (1995, p. 338) observed this when they said,

> The problem is that what many organizations are actually implementing is a pale or highly distorted version of what Deming, Ishikawa, and Juran laid out. This problem is so serious that it shaped the organization of this commentary: Had we attempted to organize our thoughts exclusively around contemporary TQM practice rather than use the philosophy and prescriptions of the TQM founders as our point of departure, it would have been impossible to write. In too many TQM programs, moreover, it is the

> difficult-to-implement portions of the program that are being finessed or ignored and the rhetoric that is being retained. Science is fading, the slogans are staying, and the implications are worrisome

Indeed, it appears that Deming's fears are now being realized. The writer examines the literature further to see how people perceive TQM, especially in regard to the observations made by Dean & Bowen (1994) and Kemper (1997) about people sometimes perceiving TQM as an independent and, sometimes as a dependent, variable. The writer also examines the literature for an insight of how TQM fits with other systems, for example, ISO 9000. Then, the writer examines the implications to the way quality is managed.

TQM as Dependent Variable

Most definitions of TQM, either directly or indirectly, suggest that it is a method, a means to achieve some outcome. However, in order for TQM to be a dependent variable, it must be considered as the outcome itself. This entails that it need be the result of one or more independent variables functioning in some concerted manner. Deming's fear that the term TQM would become the methodology thus appears well founded. Indeed the writer found only a few references where TQM could be interpreted as the outcome.

President Ronald Reagan's Secretary of Defense, Frank Carlucci, wrote (as cited in Rumsey and Miller (1990)):

> The successful TQM operation is characterized by an organization of quality trained and motivated employees, working in an environment where managers encourage creativity, initiative, and trust, and where each individual's contributions are actively sought to upgrade quality (p. 3).

The implication in Secretary Carlucci's statement is that TQM is an attribute of organizations, and thus, it depends on some series of characteristics, such as trained and motivated employees.

Rumsey and Miller (1990) also treat TQM as an independent variable, when they state:

> Yet, despite an almost ubiquitous recognition of the need to involve--better, to immerse--the people within an organization in the new culture of TQM, most failures of total quality control can be attributed to the resistance of upper level management, middle management, and line workers--probably in that order. (p. 3)

Here they treat TQM as the result of management action, indicating that it is a dependent variable.

In his book on TQM, Talley (1991) gives the following definition:

> Total Quality Management (TQM is a new management philosophy.) In June 1987 *Business Week* noted ". . . Managing for quality means nothing less than a sweeping overhaul in corporate culture, a radical shift in management philosophy, and a permanent commitment at all levels of the organization to seek continuous improvement (p. 3).

The writer interprets this to mean that Talley considers TQM as the

result of the change in corporate culture and management philosophy. TQM here seems to be equated with managing for quality, an activity where managing is the independent variable, and quality is the dependent variable.

The only other published work, treating TQM as an outcome, that the writer was able to locate was an article by Shoop (1991) in which he wrote,

> Because TQM is simply "meeting the customer's requirements, needs and expectations, the first time and every time.... If the word 'customer' confuses you, just think of whoever your work product goes to and all the other people down the line that it affects," according to the *Federal Total Quality Management Handbook,* published by the Federal Quality Institute (FQI), the three-year-old agency responsible for government-wide quality efforts. (p. 17)

Here Shoop treats TQM as the result of meeting customer's needs and expectations. TQM is, therefore, the independent variable, and meeting the customer's needs and expectations is the dependent variable. The writer learned from Mr. John Hunter of the TQM Office of the Under-Secretary of Defense for TQM, that the Federal Quality Institute (FQI) has been closed. All the activities undertaken by the FQI were transferred to the TQM Office (personal communication 12 August 1998).

Dr. Martin Stankard of the Productivity Development Group in Massachusetts (personal communication 5 January 1998) shared the

following definition tying TQM to the Malcolm Baldrige National Quality Award:

> Total Quality Management(TQM) is defined as meeting the Malcolm Baldrige National Quality Award (MBNQA) (1998) requirements for Leadership, Strategic Planning, Customer and Market Focus, Information and Analysis, Human Resource Focus, Process Management, and Business Results. Organizations must utilize a system of management values, methods and approaches which meet the requirements of the most recent MBNQA criteria sufficiently to qualify as a an organization practicing TQM.
>
> The test of observing 'sufficiently' is made by a team of 4 to 6 Baldrige-trained examiners that would include 2 or more who understand Deming. These examiners would assess the management system (values, approaches, methods) of the organization according to the most recent MBNQA criteria and scoring system.
>
> A score of 500 out of the 1,000 points on the Baldrige criteria and scoring system, with no item scoring below 30% qualifies the organization as practicing TQM.

This is an operational definition in the sense that Dr. Deming (1992) used the term, and it shows that TQM is considered an outcome of applying the MBNQA. While others defined TQM in terms of the MBNQA as well, they equated the two in terms of method, not that one was the outcome of the other. Stankard’s definition distinguishes the two ideas, looking at the MBNQA as a method or test device, and TQM as the result, if MBNQA criteria are met.

Most writers seem to consider TQM as a means to an end and not

as the end itself. The few writers mentioned above look at TQM in the opposite way. As discussed previously, a number of writers do not define TQM at all, but instead, assume that the term is known to all.

TQM as Independent Variable

The writer has accumulated 90 definitions that treat TQM as an independent variable. To make sense of this rather large number of definitions, a content analysis was performed on these definitions. Each definition was reviewed, and key words and phrases were extracted. A total of 271 phrases were collected into a concordance file. A word processing file was created with a separate for each definition. Using the word processor's built-in system to create an index from all of the phrases in the concordance file a master index of the 271 phrases was created.

The master index was then scanned for phrases with a large number of listings. Table 1 on the next page shows the result of this analysis.

A total of 90 definitions were analyzed. A number of definitions contained more than one major classification category. Therefore, the total of the categories add to more than 90. Customer satisfaction is included in the category "Customer Related", which was used in 17

definitions.

Table 1

Content Analysis of TQM Definitions
Which Treat TQM as a Method

Topic	Count
Management Related	56
Improvement, Continual and Other	53
Customer Related	47
Organization Related	42
Tools and techniques	29
Employee Related	21
Culture	7
MBNQA	6
ISO 9000	2

Management

There are several key words associated with the concept of management (in order of frequency):

(1) approach,
(2) philosophy,
(3) system,
(4) performance,
(5) practice,
(6) Japanese style, and
(7) technique.

For instance, Dean & Bowen (1994, p. 394) use both the words approach and philosophy in their definition of Total Quality, or TQ, as they prefer to call TQM. Since their definition is quoted with some degree of

frequency in academic studies, the writer includes it here as an example of what many investigators are using.

> We see TQ as a philosophy or an approach to management that can be characterized by its principles, practices, and techniques. Its three principles are customer focus, continuous improvement, and teamwork, and most of what has been written about TQ is explicitly or implicitly based on these principles. Each principle is implemented through a set of practices, which are simply activities such as collecting customer information or analyzing processes. The practices are, in turn, supported by a wide array of techniques (i.e., specific step-by-step methods intended to make the practices effective.)

Other researchers such as Brocato (1994, p, 1), Hiam (1993, p. 5), Lawler, (1994, p.68), Spencer (1994, p. 448), Waldman (1994, p. 511) think of TQM as *an approach to management*. Although the word method is used only once, it seems that the thrust of the definitions is that TQM represents a way of managing.

Several definitions touch on the responsibility of managers in the process of attaining quality. The most frequently mentioned is in the field of *commitment* and *participation*. Waldman (1994, p. 511), for instance, expanding on Dean and Bowen's definition, states that an essential element of TQM is "Upper management commitment to place quality as a top priority." Another element he feels is, "the commitment continually to improve employees' capabilities and work processes through training and

Benchmarking, respectively."

Most authors speaking about participation include all members of the organization (Mackowski, 1994; Schmidt et al., 1992; Campbell, 1998; Hiam, 1993), while others (Collins, 1994) (Rosander, 1985) consider *only* the participation of management. One could argue that participation by all members of an organization includes management, and so, all the authors who refer to participation have managers of *all* levels in mind. Admiral Collins (1994, p. 197) makes the point that the participation needs to be active, rather than passive, when he defines TQM as:

> The totality of effort and organization that includes management's active participation, support, and vision and sensitivity to both the market and to internal customers; the functional interaction of all elements involved in bringing a product or service to market and providing post sale [sic] support and recognition and reward of those whose contributions are above normal expectations.

As former Executive Director for Quality Assurance in the Defense Logistics Agency (the purchasing agent for the Defense Establishment), Admiral Collins is well aware of the problems associated with less than active participation on the part of subordinates. His view was also expressed in a quote of Admiral Rickover, known as father of the nuclear submarine, when he said: "The man in charge must concern himself with details. If *he* does not consider them important, neither will his subordinates. Most managers would rather focus on lofty policy issue

matters. But, when details are ignored, the project fails .” (p. 30, emphasis in the original.)

Improvement

The second most frequently occurring theme in the definitions of TQM is improvement. Dean and Bowen (1994), in their definition cited above, use the element of *continuous improvement*. Writers seem to use the words “continuous” and “continual” interchangeably. Deming, who prided himself on being a grammarian, used only the term “continual.”

Although the difference is slight, it is significant when used to modify the word “improvement.” *Continual* implies that the process is never-ending. *Continuous* is a process “in which no break occurs between the beginning & the (not necessarily or even presumably long-deferred) end” (Fowler, 1954, p. 94). The *-al* form of the word implies never-ending improvement, while the *-ous* form of the word implies some end point beyond which no further improvement is sought.

A consideration of the Loss Function as described by Professor Taguchi (1981), shows the importance of the word “continual”. For any given loss function (often a parabola with focus perpendicular to the target value), there exists a point at which the marginal utility of further improvement is zero or less. By using the word “continuous”, the

implication is that one stops improvement when this point is reached. However, the curve is market-driven, and thus it can change with the introduction of new products. An organization that has stopped its improvement process can find itself losing market share with great rapidity.

An example of this effect is the American automotive industry when Japanese cars began to dominate the market place. A specific instance is the Ford Batavia Trans-axle Plant Experiment. In a video analyzing the experiment, John Betti, the then Vice President of Powertrain and Chassis, described the results and that Ford learned not merely to make parts to print, but to work on “Continual Improvement”, if they wanted to survive in the market place. While Ford sat on their laurels once they made parts to print, the Japanese used Continual Improvement to make a better transmission, which in turn shifted the loss function causing Ford to lose market share.

Some authors such as Campbell (1998) see TQM as our answer to “Japanese-style management approach to quality improvement” (p. 64). He feels that TQM is essentially a “management approach to long-term success through customer satisfaction.” Presumably, this long-term success is achieved via process changes which one hopes are improvements.

Hammer and Champy (1993) in their book on Re-engineering, dismiss the concept of improvement when they state: “Nor is Re-engineering the same as quality improvement, total quality management (TQM), or any other manifestation of the contemporary quality movement” (p. 49). They are looking for “breakthroughs.” However, breakthroughs are improvement, so it is hard to see their distinction.

Authors such as Grant, Shani, & Krishnan (1994) believe that TQM and "other management methods" are in conflict with each other. Therefore, managers must chose one or the other (p. 26). They define "TQM [as] a company wide philosophy of quality improvement" (p. 28).

To Schonberger (1992), *improvement* is the key to TQM. He says, “TQM is a set of concepts and tools for getting all employees focused on continuous improvement, in the eyes of the customer” (p.16). The term, “all employees”, includes management thus when Schonberger speaks of a set of concepts, one can assume that he is talking about management concepts that lead to improvements.

Kordupleski, Rust, & Zahorik(1993), writing on “Why Improving Quality Doesn't Improve Quality (Or Whatever Happened to Marketing?)” feel that TQM is entirely focused on *internal* business affairs. They say, “When managers refer to such terms as TQM, what they usually mean is using the tools of quality to improve internal business processes” (p. 83).

Like Schonberger, they see TQM as a set of tools. It is interesting to see that many authors believe the improvements are market related (meeting customer's needs or satisfying customers), while the Kordupleski et al. (1993) see TQM as applied only internally.

To Eskildson (1995, p. 1129), improvement comes into play in two of the five major elements that he feels are the core components of TQM. The first he calls, "A priority emphasis on improving quality and customer satisfaction, primarily through preventing problems", and the other is "Continual Improvement." This writer notes that he separates the two elements, whereas one appears to be a subset of the other.

Some 25 out of the 53 definitions that deal with the element of "improving" also deal with some customer issues. In fact, eight of these tie the improvement directly to the customer. (See Barrow, 1993; Dean & Bowen, 1994; Dobbins, 1995; Eskildson, 1995; Feinberg, 1995; Moe, 1995; Potocki, 1995; and Powell, 1995).

Customer Related Issues

The most common element relating to customers in the definition of TQM is "satisfaction." Of the 47 definitions that involve customers, 20 relate specifically to their satisfaction. For instance, the first major component in Eskildson's (1995) description of TQM is "a priority

emphasis on improving quality and customer satisfaction, primarily through preventing problems" (p. 1129).

Many books also use customer satisfaction as a mainstay in their author's definition of TQM. Drummond (1992) defines it as being "basically a business philosophy founded on customer satisfaction" (p.13). Cohen (1995) notes that "all approaches to TQM contain a strong element of aiming for customer satisfaction" (p. 321). Campbell (1998) considers TQM to be "a management approach to long-term success through customer satisfaction" (p. 64). One of Broka and Broka's (1992) definitions is that TQM is "a system of means to economically produce goods and services that satisfy customer requirements" (p. 4). Other researchers, such as Krieter (1996), refer back to Broka and Broka's definition. Evans and Lindsay (1996) consider TQ (Total Quality) to be a system that "aims at continual increase in customer satisfaction at continually lower real cost" (p. 16).

Another category of modifiers for the focus on the customer deals with their needs, requirements and expectations. Deming thought that the word "need" was more realistic than "requirements" or, by extension, "expectations." As he put it, "There is much talk about the customer's expectations. Meet the customer's expectations. The fact is that the customer expects only what you and your competitor have led him to

expect. He is a rapid learner" (Deming, 1994, p. 7). In fact, the customer's needs may be greater than his expectations or his stated requirements. If one meets and exceeds the customer's needs, one is in a position to *delight* the customer.

Brocato (1994) looks at needs of the customer on a time scale. He talks about "the degree to which the needs of the customer are met, now and in the future" (p. 12). This is taking a longer range view than do other writers. Since Dr. Brocato's dissertation dealt with applying TQM methods to the educational process, it is understandable that he considers the future needs of the students.

Another element in the definition of TQM uses the word "focus" in connection with the customer. Seven of the writers, Barrow (1993), Crouch (1992), Dean & Bowen (1994), Dobbins (1995), Easton & Jarrell (1998), Moe (1995), and Pulat (1994), connected the concept of focus with customer. For example, one of the nine key characteristics of TQM listed by Easton and Jarrell (1998, p. 254) is "customer focus."

Deming, in his lectures to the Japanese in 1951, indicated that customer focus had always been an interest of "intelligent manufacturers ... but until recently [the 1940's] they had no economic or reliable way of investigating them" (1951, p. 9). In his introductory remarks, Deming (1951) discussed consumer research, as well as the need for

organizations not merely to research their customers, but also to look at their non-customers (pages 6 - 12). This notion of customer focus resulted in Figure 4, The Shewhart Cycle, shown on 24.

The need for customer focus is also expressed by Lengnick-Hall (1996, p. 792), who feels that a firm must be customer oriented. The same idea is echoed by Kordupleski, Rust, and Zahorik (1993) whose concept of customer focus is to determine the customer's needs and to then organize a system of quality measurement related to these needs (p. 85).

Thus, the customer is an essential ingredient in many of the definitions of TQM. However, the concept of customer is not limited to the ultimate consumer. The customers could even be the people receiving work from another department internally.

As stated in Chapter 1, when discussing the Integrated Process Model, Hessel, Mooney, and Zeleny (1988) state that, "the customer is the purpose and driving force of the enterprise and must be integrated into the process of production and service delivery" (p. 142). Many TQM definitions contain this concept, although not all of them are as explicit as Hessel et al.

Organization Related Issues

Over forty of the definitions deal with some aspect of organization. Many simply refer to an organization in their definition. For example, Price and Chen (1993) note that “TQM is a management system, not a series of programs. Many of the tools promoted as part of TQM can be successfully applied within any organization, but the full benefits cannot be obtained without changing the attitudes and priorities of day-to-day operations” (p. 96). Others talk about what TQM is *supposed to do* for organizations. For instance, Krieter (1996) uses the following definition, “Total Quality Management (TQM) is a way of continuously improving performance at every level of operation, in every functional area of the organization, using all available human and capital resources” (p. 71).

Some writers, such as Spencer (1994) deal with *organizational processes* in their definition, rather than the organization as a structure. Waldman (1994) believes that “TQM may be viewed as a shift in both thinking and organizational culture (Sashkin & Kiser, 1993)” (p. 511). Gibson, Ivancevich, and Donnelly (1994) see that “TQM is an organizational development first and a management practice second” (is not organizational development a management practice?). Barrow (1993), in examining if TQM equals organizational learning, gives as an operational definition of TQM that “in the total quality organization,

customers drive the overall system. There are explicit relationships within the organization, and feedback reinforces and enables change and organizational learning" (p. 39).

Woods and Cortada (1995) associate QualiTrends (their term for TQM) with "any intelligently managed organization" (p. viii), a practice that they call *management*.

Thus, the organizational issues found in TQM definitions deal with the structure of organizations, the impact on organizations and the functions of organizations. In some cases, they also deal with how organizations are run.

Tools and Techniques in the Definition

Nearly one third of the definitions (29) refer, directly or indirectly, to tools or techniques that help to achieve quality. Those that touch on the subject indirectly talk about tools in general. For example, Kardopleski, Rust and Zahorick (1993) state, "When managers refer to such terms as TQM, what they usually mean is using the tools of quality to improve internal business processes" (p. 83). The official definition proposed for the Department of Defense (1989) also uses the general term: "TQM integrates fundamental management techniques, existing improvement efforts, and technical tools under a disciplined approach focused on

continuous improvement" (p. 1).

The generic terms found in TQM definitions range from the word tool(s) by itself or modified as technical tools to quantitative methods.

When actual methods are cited the one occurring most frequently is Statistical Process Control (SPC), either as such or as its principal tool, the control chart. For instance, Hackman and Wageman (1995) talk about the ". . . three of the most commonly used tools are control charts (statistical process control), Pareto analysis, and cost of quality analysis" (p. 315).

Lawler (1994) believes that "Total quality management is best viewed as a management philosophy which combines the teachings of Deming and Juran on statistical process control and group problem-solving processes with Japanese values concerned with quality and continuous improvement." Actually, Deming (1951) taught the Japanese the use of statistical process control as a management *tool*. However, the group problem solving process seems to stem more from Dr. Juran's 1954 lectures, according to Dr. Ishikawa (1985 p. 19), who is widely acknowledged as the innovator of the Quality Control Circle movement.

Among the methods specifically mentioned by name are such statistically oriented disciplines, such as Design of Experiments (DOE) and SPC. Not everyone defining TQM in terms of tools is happy with that

aspect. As Spitzer (1993) observed: “Unfortunately, [TQM] has become associated more often with statistical methods, such as statistical process control and design of experiments, than with a method of management” (p. 61). Yet, judging by the fact that two thirds of the definitions of TQM found by the writer do not mention tools, and only a handful mention statistical tools, the writer feels that Spitzer’s view is not supported.

Almost all of the other methods mentioned in the definition of TQM are non-statistical, such as:

- Benchmarking,
- brainstorming,
- cause and effect diagrams (actually a special form of brainstorming),
- check sheets,
- cost of quality,
- employee involvement and/or empowerment,
- failure mode effects analysis (FMEA),
- quality function deployment (QFD), etc.

A special case, mentioned in some of the definitions, is the Pareto principle which uses graphics in displaying an ordered histogram. While histograms are used in statistical work, the Pareto diagram is essentially a decision tool invented by Dr. Juran (1964) to separate the “vital few” cases from the “trivial many” cases (pages 43 - 54). In recent years, Dr. Juran (1988b) used the more descriptive words, “useful many”, to describe the residual left after removing the vital few (p. 33).

There is *no* uniform set of tools or techniques that are consistently

associated with TQM. Most of the methods mentioned come, as Lawler (1994) points out, from the teachings of Deming, Ishikawa and Juran. The concept of cost of quality is often associated with Crosby (1979), who popularized the concept. Yet, it is not clear if it was developed by him, Feigenbaum (1961), or Juran (1988a).

Employee Related Issues

The two most frequently mentioned issues relating to employees are *employee involvement* and *employee empowerment*. Unfortunately these two concepts, as appealing as they are, lack clear definitions. Consequently, one can easily use the term meaning one thing, and find that for others, it has a completely different meaning. The closest that the writer was able to get in the way of a definition for employee involvement was from Evans and Lindsay (1996) who state: “Participation and teamwork–the foundation of **employee involvement (EI)**–represent core principles of total quality management and are a natural extension of effective human resource management practices” (p. 440-441, emphasis in the original). The authors go on to describe the advantages of such practices. They also go on to describe how the president of a United Paper workers Local felt about this method of managing citing an article in the 10 July 1989 issue of Business Week called, “The Payoff from

Teamwork:"

> What the company wants is for us to work like the Japanese. Everybody go out and do jumping jacks in the morning and kiss each other when they go home at night. You work as a team, rat on each other, and lose control of your destiny. That's not going to work in this country" (Quoted in Evans and Lindsay, 1996, p. 442).

The writer's experience indicates that, because of past management practices, the union boss' assessment appears to be more realistic than the ideas stated in TQM definitions, no matter how desirable these may be. If participation in the operation of the company and teamwork are to be a reality, companies will need to make some considerable changes in management style from the top to the bottom. Deming (1994) has been pleading for just such a transformation for years. In a deposition to the U.S. Interstate Commerce Commission (ICC) on 23 August 1990 he said, "This nation is at a crossroads in terms of our resolve to recognize and meet the challenge [of quality]. Transformation is required. Transformation will not be spontaneous" (p. 77-78). In the writer's opinion, without transformation of prevalent management practices, employee involvement, no matter how desirable, simply will not work. In effect, that is the message of the Union leader who was quoted above.

Some organizations such as the Ritz-Carlton Hotels and G.O.D.

Trucking company have in fact achieved such a transformation resulting in substantial payback through their employees' involvement. However, until true employee involvement is obtained, the more powerful next step of employee empowerment is not really possible.

At the 1992 Baldrige Award, Ritz-Carlton Hotels reported that an independent survey disclosed that 92 - 97% of the guests had a memorable experience. As the article reported, this was "a feat that Horst H Schulze attributes to the employees and the Baldrige Award Process." (Bemowski, 1993, p. 29).

Mr. Patrick Mene, Corporate Director of Quality of Ritz-Carlton, told the writer that the corporation was able to de-layer the management of their operation because of their success with employee empowerment (personal communication by telephone July 22, 1999). The now have only three layers:

- Corporate management,
- Hotel Senior Management, and
- Hotel management.

Their quality scores continue to rise and their productivity continues to improve. Mr. Mene attributed these success indicators to Ritz-Carlton's use of employee involvement and empowerment.

The author's experience with Guaranteed Overnight Delivery (G.O.D.), presented several examples. G.O.D. found that by involving the

employees in redesigning the process of trucks arriving at the main terminal, that they saved enough time to turn all loads around before midnight. This allowed all trucks to meet their deadline for next morning delivery. Another case was the decision to honestly report all damage rather than follow the industry standard of hiding damage by repackaging skids. This built up a trust with the warehouse personnel. In consequence, G.O.D. trucks could unload anytime, have their receipts validated and leave without waiting for an inspection of the merchandise. This saving of time allowed more deliveries per day, saving the company a substantial amount of money.

Mr. Walter Riley, owner of G.O.D., told the writer that they still have a very active employee involvement using teams of about 7 employees to solve problems (personal communication 23 June 99). This effort has reduced turnover and improved employee morale.

The closest to a formal definition of employee involvement that the writer found was also in Evans and Lindsay (1996), who hold that "empowered employees are able to make decisions on their own to satisfy the customer" (p. 167). They cite a number of examples, such as that employees at Ritz-Carlton Hotels who can "spend up to $2,000 to satisfy a customer" (p. 398). In practice, the writer has found very few firms that are willing to give this much responsibility to their employees.

While most of the references in the definitions of TQM relate to employee involvement and empowerment either under that cachet or under designations such as teamwork, employee development and the like, some definitions deal with employee matters in a more adversarial style. For instance, Schonberger (1992), defines TQM to be, “a set of concepts and tools for getting all employees focused on continuous improvement, in the eyes of the customer--the next process as well as the final consumer” (p. 16). Likewise, Rau (1995) defines TQM to be (in part), “encompasses such tools and techniques as statistical process control, goal alignment, and failure mode effects analysis, while channeling the mind-set of every employee to achieve continuous improvement” (p.57).

The majority of definitions when discussing employees deal with the need for their training, involvement, and empowerment.

Culture

Those writers that use the concept of culture in their definition tend to think in terms of change in the culture of the organization. For instance, Waldman (1994), states that “TQM may be viewed as a shift in both thinking and organizational culture” (p. 511). Campbell (1998 p. 64) sees the foundations of TQM to be grounded in the improvement of the organizational culture, while Collins (1994) looks towards “. . . creating a

culture in which concern for quality is an integral part of product/service delivery" (p. 40).

Some of the writers are specific in that the culture of the organization is founded on quality. One of the elements of TQM, according to Sashkin and Kiser (1992), is "the development of a quality culture." To Ginnodo (1992), "TQM is, to put it simply, the way one manages within a total quality culture."

Malcolm Baldrige National Quality Award

Eight of the definitions of TQM refer to the Malcolm Baldrige National Quality Award (MBNQA) in their description of TQM. For instance, Easton and Jarrell (1998), "define TQM to be a management system that substantially addresses the criteria of the Malcolm Baldrige National Quality Award" (p. 254). Professor Easton has worked as a Malcolm Baldrige National Quality Award examiner and is, therefore, very familiar with the criteria of this award.

While most of the definitions equate TQM to MBNQA or vice versa, Professor Kelada (1997) distinguishes TQ (Total Quality) and TQM from the MBNQA when he states, "let us point out that the famous Malcolm Baldrige National Quality Award has never used the TQ or TQM labels. Moreover, since 1995, the word "quality" has almost disappeared from the

list of criteria for obtaining this Award, thus suggesting that managing quality is no less than managing the organization itself" (p.378). It appears that Professor Kelada is converging on Dr. Deming's view that TQ or TQM is an outcome of management methods, not an activity in its own right. However, in later communication to the writer, Professor Kelada (personal communication, April 8, 1998) looked at TQM as the "activities required to achieve and maintain total quality." Among these activities he includes "Malcolm Baldrige Diagnosis criteria" among other "practices such as: Benchmarking, . . . , Quality Function Deployment, FMEA, ISO 9000" etc.

ISO 9000

The International Standards Organization (ISO) issued a series of Quality Systems standards that are generically called "ISO 9000" although the standard numbers range from 9000 to 9004. Some organizations such as the Automotive Industry Action Group (AIAG), have published industry specific variations of the standards. The AIAG standard is known as "Quality System Requirements: QS 9000."

Unlike the Malcolm Baldrige National Quality Award, the writer found no definitions that equated TQM to ISO 9000. This is probably best explained by Easton and Jarrell (1997) when they stated,

> It should be noted at the outset that ISO 9000 standards are

> standards for a quality assurance system at the plant level. During the period of [Anderson, Daly, and Johnson's (1995)] study, the ISO 9000 standards focused virtually entirely on quality control issues and not on continuous improvement. The ISO 9000 standards in no way represent a comprehensive TQM system. (p. 22)

Professor Kelada (1997), who teaches at the École des Hautes Études Commerciales, Montréal (HEC), also sees ISO 9000 as a subset of TQM. In his view, ISO 9000 helps to achieve what he terms Total Quality. In a note to the Deming Electronic Network (DEN), he stated, “For example, one of the tools of total quality assurance is the ISO 9000 (which, by the way, is totally useless unless you apply it in a larger approach which is TQM-HEC style)” (J. Kelada, personal communication, April 19, 1998).

Apparently, those engaging in defining TQM do not consider Quality Systems to be more than a tool or method used to achieve quality. This is an interesting result, especially since ISO 9000 is often mentioned as the means for buyers to be assured of the quality of their suppliers.

Summary of TQM Definition

Based on the foregoing review of definitions of TQM, a composite definition can be made as follows:

Total Quality Management (TQM) is a management method to

continually improve the organization's processes and culture to meet the needs of both the internal and external customer by applying tools such as Statistical Process Control (SPC), Ishikawa's seven tools, and others.

While this definition includes the majority of concepts found in those the writer accumulated, it still implies that *quality is a method*. In fact, it is *the result of applying a method*. The problem lies in the term used. Although it has a nice cadence, the word "management" is modified by "total" and "quality". Writers, like Dean and Bowen (1994), recognized this problem and tried to remove it by dropping the word "management." The result, Total Quality (TQ) seems even *less* meaningful to this writer since it implies that less than total quality can exist and removes the connection between quality and management.

Because of the semantic difficulty with the term TQM, it has taken on many varying meanings to managers. The above definition can be considered as an average, with large variation about it. As a result, when managers use this term, it is important to get a clear definition of what they mean. Based on the different meanings of TQM, different approaches to managing operations for quality can evolve. A hypothesis of this study is that the varying background of managers and the firms in which they operate, can result in different interpretation of TQM and different approaches to managing for quality.

Tools

In discussion about consultants, Juran is reported to have said that if they have only a hammer, every problem looks like a nail (G. H. Blackiston, president, Juran Institute, personal communication, December 9, 1998). The U.S. Department of Defense, in the draft to their *Total Quality Management Guide* (1989) also state, “If your only tool is a hammer, everything looks like a nail” (p. 49).

Kaplan (1964) in his book calls “it *the law of the instrument*, and it may be formulated as follows: Give a small boy a hammer, and he will find that everything he encounters needs pounding” (p. 28, emphasis in original). Kaplan (1964) goes on to say that people use those methods and tools in which they are especially skilled. He further states that there is nothing wrong with this, as long as other methods are not denigrated because of the familiarity with a particular method or tool.

Although there are a large variety of tools associated with TQM, only a few authors (for example, Brocka & Brocka, 1992) make extensive lists of these tools and methods. Most authors list commonly used tools or those that they feel are applicable.

Brocka and Brocka (1992, p. 177) list 59 tools in different categories. Of these, 28 are unduplicated. Of the 28 unduplicated tools and methods, one could question whether some are not a subset of

others. For instance, brainstorming, nominal group technique (NGT), Delphi technique, and cause and effect diagrams are all variations of methods trying to define those factors that influence outcomes. Furthermore, the writer would not consider “service quality” as a distinct tool or method for TQM. In fact, the authors themselves state, “Service quality is infused throughout all tools and concepts” (Brocka and Brocka, 1992, p. 266). Since service quality is the result of the application of methods and tools, the writer contends that *all* tools and concepts are infused throughout operations leading to service quality, not the other way around.

Kanji and Asher (1996) chose as a title for their book, *100 Methods for Total Quality Management*. Again, to get to 100, their list of tools and methods experiences the same fragmentation as did Brocka and Brocka’s list. Kanji and Asher list every type of control chart as separate entries. One finds c-charts, Cusum charts, multi-vari charts np-charts, p-charts, charts for individuals, $\overline{X}$ and R-charts, and Statistical Process Control (SPC) all listed separately. Most other writers incorporate these charts under the generic heading of “Control Charts.” One should note that even with 100 tools and methods, Kanji and Asher are not complete. Using their way of looking at each item as a separate tool or method, they omitted such items as: the median control chart; acceptance sampling (they only

mention Acceptable Quality Level (AQL) but not the other characteristics of the Operational Characteristics Curve (OC) (such as RQL, LTPD, etc.); and the Average Outgoing Quality Limit.

A Discussion on Classifying Tools for TQM

The term “tools” is used here in a generic sense, including both tools and techniques or methods. The distinction between *tools* and *methods or technique* can help in the classification of these application for TQM. This section reviews existing classifications and proposes a typology.

Distinction Between Tools and Methods

Wilcox, Dale, Boaden and McQuater (1995), in their publication, *Using Quality Tools and Techniques Successfully*, are careful to distinguish between “tools” and “techniques.” They define a tool “as a device that has a clear role. It is often narrow in focus and is usually used on its own” (p.3) Techniques or methods they define “ . . . as a collection of tools.” They use the example of Statistical Process Control (a method) which uses tools such as control charts, process capability studies, etc. Indeed one way of classifying the instruments for TQM is whether they are tools or methods.

Lloyd Provost (personal communication, April 14, 1998) stated on the Deming Electronic Network (DEN) the following definition for method: “A systematic approach to some aspect of improvement; a collection of procedures, techniques, and tools used as a strategy to accomplish improvement.” His definition for tool is, “something used in performing an improvement activity; a device or construct used in improvement activities.” He goes on to note that “both the words ‘methods’ and ‘tools’ are concepts whose meaning can change with different contexts. My methods may be thought of as tools to others with a broader view.”

Because of this factor, the differentiation between tools and methods, while sounding easy, can in fact be complicated. For instance, Quality Function Deployment (QFD) can be thought of, in a narrow sense, as a specialized form of matrix analysis to develop design specifications. In such a use, QFD would be a *tool*. The writer believes that this is the most common use of the method. On the other hand, King (1987) uses it as a *method* that includes the seven tools of management, only one of which is the matrix analysis.

Existing Classifications

Those writers that list a large number of tools, as well as some other researchers (for instance, Stoner et al., 1994), found it necessary,

and/or convenient, to classify tools and methods in categories. There are many different ways in which various writers classified their list of tools.

Kanji and Asher (Kanji et al., 1996) use four overall categories:

(1) management methods,
(2) analytical methods,
(3) idea generation, and
(4) data collection, analysis, and display.

Brocka and Brocka (1992) use two separate sets of classification. The first divides the tools and methods into six categories:

(1) organizing,
(2) planning,
(3) self-examination,
(4) group techniques,
(5) statistical tools, and
(6) specialized techniques.

Their second typology uses the following eight major categories:

(1) graphical tools,
(2) company-wide techniques,
(3) data analysis,
(4) problem identification,
(5) decision-making tools,
(6) modeling tools,
(7) preventative tools, and
(8) creativity tools.

Several tools and methods appear under more than one heading in this typology. For instance, QFD is found under four headings, sometimes as a *tool* (e.g. as a “graphical tool”) and at other times as a *technique* (e.g. as “company wide techniques”).

Stoner & Werner (1994) in their study of financial management and quality state: “The finance functions in the study companies have added three sets of quality management methods (or tools) to the well-established financial analysis, planning and control tools used by essentially all well-managed companies” (p. 50) They go on to classify the three sets as

(1) “numerical and analytical methods”,
(2) “behavioral methods”, and
(3) “competitive Benchmarking.”

The first two methods they mark parenthetically as tools.

The Department of Defense (DoD) (1989) in their list of tools show a table summarizing the 18 tools by their place in “Problem-Solving Activities.” This cannot be a classed as a good typology since the tools are used in more than one activity as was the case with Brocka and Brocka (1992) second type of classification. The six classes of activities used by the DoD are:

(1) “Bounds & Prioritizes Problems”,
(2) “Compile information”,
(3) “Analysis”,
(4) “General Alternatives”,
(5) “Evaluate”, and
(6) “Plan & Implement” (p. 50).

Soin (1992) divides tools and methods into two classes, “The Seven Quality Control Tools and the Seven New Tools” (p. 297). He

indicates that “Kaoru Ishikawa has stated that the seven tools [of quality control] can be used to solve 95% of all problems.”

According to Zultner (private communication, April 16, 1998) the Japanese Union of Scientists and Engineers, commonly called JUSE, “has ongoing research on quality tools. They are the ones who ‘packaged’ the initial set of 7 tools for Quality Control. . . . As the only Quality organization actively researching tools for quality, they have the only ‘official’ bundle(s).” Because they are the only agency that seems to be working on tools, Zultner felt that they were de facto official.

According to him, JUSE has three groups of seven tools each. The groups are:

(1) “The 7 Basic Tools of Quality Control”,
(2) “The 7 New Management and Planning Tools”, and
(3) “The 7 Newest Tools for Product Planning.”

This is a classification based on the order of appearance. The “Seven Basic Tools” were initially formulated by Ishikawa (1983) around 1960. The “Seven New Tools for Management” seemed to have been developed starting in 1972 by a group called “The Society of QC Technique Development”. The introduction does not make it clear if this is a committee of JUSE. The work proceeded under the guidance of professors Mizuno and Kondo (1988, p. xii). According to Mr. Zultner, the most recent set of tools comes from a definitive work by “Kanda, Noriake,

Tadashi, Shinichi, Tsutomo, et al. 1995. Seven product planning tools: A tool set for new product development. Tokyo: JUSE Press."

Mr. William W. Eggleston (1991), a former Corporate Vice President at IBM, classifies tools into four main categories:

(1) "Defect Identification",
(2) "Cause Analysis",
(3) "Corrective Action", and
(4) "Test Evaluate" (p. 65).

It can be questioned whether some of his tools and techniques are truly such. For instance, he includes consultants and pilot plants among the tools and techniques. It is possible that from the standpoint of a senior executive in a major corporation such aspect are considered tools and techniques. In terms of this research, that will be an interesting area to explore.

Hollingworth (private communication, April 19, 1998) uses four categories to cluster tools of TQM:

(1) "Statistical methods to gain insight from data",
(2) "Systems analysis methods to understand relationships",
(3) "Semantic methods for communicating and developing ideas and information using words", and
(4) "Learning strategies for developing knowledge e.g. PDSA."

A Proposed Taxonomy

The single most consistent classification appears to be dividing the tools and techniques into the 7 basic tools of quality control, the 7 new

management tools and all others. Several writers (for instance Brocato, 1994; Tachiki, 1995; Soin, 1992) use this basic classification. The writer feels that this leaves a number of important procedures unclassified. Thus the writer initially proposes that a distinction be made first of all whether the procedure is a *tool* or a *method*. Secondly, it is proposed that the procedure should be classified as to whether it is *qualitative* or *quantitative*. It is proposed that the qualitative classification can be further subdivided into *process defining* or *process controlling* categories. In a like manner, it is proposed that the quantitative procedures be divided into *stochastic* and *non-stochastic* categories. An example of TQM procedures classified according to this proposal is given in Appendix B.

Ishikawa and TQM Tools

Ishikawa is widely credited with inventing the concept of Quality Control Circles (QCC). In the early 1950's, Ishikawa was exposed to Dr. Juran's (1964) work on Managerial Breakthrough Techniques (MBT). The writer observes that there are many aspects of QCC that are found in the MBT. In fact, they are so strikingly similar that the writer cannot help but feel that QCC is MBT adopted to Japanese conditions. Apart from two items, the composition of the team and the use of the cause and effect diagrams in lieu of brainstorming, the methods are alike. If nothing else,

the use of the Pareto chart (invented by Dr. Juran) by QCC's points to the adoption of MBT.

Since the QCC's were composed of people who were not particularly skilled in statistical methodology, Ishikawa selected the basic tools of MBT plus the control chart as the primary tools for QCC. Ishikawa (1985) called the seven tools that he chose as "indispensable" and useable by all without the need of a great deal of technical training. As he stated, "From my past experience, as much as ninety-five percent of all problems can be solved by means of these tools" (p. 198).

The seven tools selected by Ishikawa were the:

(1) "Pareto chart",
(2) "cause and effect diagram",
(3) "stratification",
(4) "check sheet",
(5) "histogram",
(6) "scatter diagram", and
(7) "graph and control chart" (p. 198).

Collectively, he called these the "Elementary Statistical Method" although, technically speaking, not all of the tools are based on stochastic principles. This is true, for example, when one uses a bar chart instead of a histogram. Most members of a QCC do not know the difference and fortunately, for the purpose that they use it usually does not matter. (In a bar chart, the *length of the rectangle* is proportional to the frequency while in a histogram, the *area on the rectangle* is proportional to the class

frequency. As long as the width of the rectangle remains the same, the distinction does not matter.)

Most people no more than the seven basic tools. Ishikawa (1985), however, notes that there are two other classes of tools used to manage quality. He calls these “Intermediate Statistical Methods” and “Advanced Statistical Methods” (p. 199). The “Intermediate” methods include,

(1) “Theory of sampling surveys”,
(2) “Statistical sampling inspection”,
(3) “Various methods of making statistical estimates and tests”,
(4) “Methods of utilizing sensory tests”, and
(5) “Methods of design of experiments” (p. 199).

Under the “Advanced Statistical Methods” he lists

(1) “Advanced methods of design of experiments”,
(2) “Multivariate analysis”, and
(3) “Various methods of operations research (OR)” (p.199).

One assumes that the advanced methods would include, among others, such things as:

- Fractional Factorial Design,
- Evolutionary Operations Processes (EVOP),
- Factor Analysis,
- Discriminant Analysis,
- Mathematical Programming, and
- Waiting Line Theory.

He does not list the details in his book.

Ishikawa (1985) tells how data problems, which occurred in his post graduate experience with chemical experiments in 1947, led him to turn to

the study of statistical methods and eventually the study of quality control (QC). His experience taught him that “engineers, who pass judgement based on their experimental data, must know statistical methods by heart” (p. 3). This led him to the conclusion that “by studying quality control, and by applying QC properly, the irrational behavior of industry and society could be corrected” (p.3). This seems to be the basis for his strong emphasis on statistical thinking and statistics as a tool for QC. Even in the basic seven tools, he advocates the use of *some* statistical methods, such as control charts.

In another book written for Quality Control Circle leaders and members, Ishikawa (1983) not only covers how to apply the basic seven tools, but also covers such things as:

- elementary sample theory,
- acceptance sample theory,
- the use of Mosteller-Tukey’s Binomial Probability Paper,
- tests for correlation, and
- contingency tables.

These statistical tools are used by Japanese Quality Control Circles (QCC’s) as seen by the examples of QCC case studies published by Ricoh Company (1982). The writer has not come across any such applications in American QCC’s. In most of the many cases the writer has seen, the American circles seem to content themselves with using cause and effect diagrams (or some alternative form of brainstorming), flow

charts, check sheets, Pareto charts and histograms (usually in the form of bar charts).

Professor Ishikawa had great regard for quantitative tools and methods. He learned to appreciate quantitative tools because of his early experience with the problems of experimentation. The writer, who early in his career also worked as a chemical engineer, can appreciate Ishikawa's liking for such tools. Chemists are generally taught to vary one element at a time and observe the impact, which is an inefficient method of experimentation. When the writer discovered design of experiments, fractional factorial experiments, and response surface analysis, such as EVOP, his experimentation became far more efficient and cost effective. From these tools, it is a simple step to related tools of quality such as the control chart.

Summary of Tools and Methods

There are many tools and methods available for use in obtaining quality. It is proposed that the distinction between tools and methods helps understand their nature and application. Appendix B lists the major tools and methods and gives a brief description of each. The tools and methods are further subdivided by qualitative and quantitative functions. The qualitative tools and methods are used either to define/refine the

process or control it. The quantitative tools are either stochastic or non-stochastic.

Since quantitative tools require strict adherence to rigid concepts to be valid, they are more difficult to apply. These are probably the tools that Hackman and Wagemen (1995) referred to when they wrote, “In too many TQM programs, moreover, it is the difficult-to-implement portions of the program that are being finessed or ignored and the rhetoric that is being retained” (p. 338). Yet, according to Ishikawa (1985), Deming (1992), and Shewhart (1931), these are the tools needed to control quality. Is it possible that managers with technical backgrounds are less likely to ignore these tools?

Benefits of TQM

A number of studies have been undertaken to determine the value of TQM to an organization. Easton and Jarrell (1997) made a critical review of nine academic and two non-academic studies. They found that a major problem of these studies was to determine whether the firm was truly practicing TQM over an extended period of time. A number of studies used surveys and relied on the respondent to identify whether they were involved in TQM (undefined) or not.

Hiam (1993), writing for the Conference Board, reviewed 20 studies

made between 1989 and 1992. Five of these were other Conference Board studies. Fifteen of the studies were labeled quantitative, four qualitative and one both. The Ernst and Young study (1991) was listed as being both qualitative and quantitative. On reviewing what the Ernst & Young report said about their research methodology, this writer found that the researchers used a judgement sample with a questionnaire. They apparently used focus group interviews to develop the questionnaire, field tested it in the four countries involved, and then distributed the questionnaire to selected companies. The methodology section does not make clear whether they kept distributing the questionnaire to other companies, in the case of non-responses, until they got 500 or more responses. Easton and Jarrell's (1997, p. 16) comment that, "against academic standards, the study is seriously deficient" seems quite justified and possibly understated.

Kano's Study of Deming Winners

The earliest study found by the writer was by Kano, Tanaka, and Yamaga (1983). This study compared Deming Prize Winner Companies to all manufacturing companies based on:

- profit,
- safety,
- empowerment,

- turnover, and
- productivity.

This covered the period from 1970 to 1980, and the study showed that Deming Prize Companies had a profitability roughly *twice* that of all Japanese manufacturing. Similar effects were seen for the other indicators as well, although the impact was not as great as that observed on profitability.

Soin (1992) apparently was able to get a later comparison of the profitability data that showed the gap to be narrowing between 1980 and 1985. Still, the profitability of the Deming Prize Companies is still well ahead of the profitability of all Japanese manufacturing.

Ishikawa (1985) felt that the use of statistical tools was paramount in achieving quality output. His student, Kano, apparently felt the same way. Since Kano is an instructor and examiner for JUSE's Deming Prize, the writer concludes that Deming Prize Companies use quantitative methods to a large extent.

This point is reinforced by a story Kano (1993, p. 18) relates when he coached Florida Power and Light (FPL) to be eligible for the Deming Prize. Apparently, on Kano's first visit to FPL, they showed him a Pareto chart that indicated that lightning was the major cause for power interruption. FPL's supposition was that Florida had the most "frequent

and severe lightning attacks in the United States and that groundings or arresters would not have prevented service interruptions produced by strong lightning." On being challenged to produce data to prove this, they had none, but they promised to collect it. On a later trip, Dr. Kano learned from FPL that they collected the data. It showed not only that outages occur with weak, as well as strong storms, but such occurrences were caused by "a certain percentage of poles with absent or insufficient groundings which they had not recognized until they collected the data" (p, 18).

The point is that statistical use of data seems to be a key element of the discipline needed to gain the Deming Prize and that the outstanding financial performance of the winners seems to stem from the use of statistical methods, as well as the qualitative tools.

Development Dimensions International Survey

The Development Dimensions International (DDI) Survey (1993) was sponsored jointly the Quality & Productivity Management Association (QPMA) and *Industry Week*. Unlike the Ernst & Young survey, DDI gives a good deal of information about the research methodology, including a copy of the instructions and questionnaire they used. Again, as a quantitative research methodology, there are weaknesses that could lead

to questioning the results. Even though the absolute number of respondents is very large, the non-response in each of two groups sampled is also very large. If the non-responders were not responding because of the way they felt about the subject matter, this could have a dramatic effect on the results.

The definition of TQM used in the survey, “a customer-focused, strategic, systematic approach to continuous performance improvement” (Wellins et al., 1993, p. 61), allows a lot of latitude in response.

The majority of the responses seem to have high to moderate agreement that their organization experienced success with TQM. A chi-square test by the writer showed that the Executive sample response differed substantially from the Multilevel sample response. For instance, the Chi-square value for rating Operational Results was 12.087, with three degrees of freedom.

The Executive sample were respondents of a random sample of a strata of 3000 *Industry Week* subscribers. The sample of 3000 was drawn from anyone with a title of manager or higher. The Multilevel sample was intended to include only 15% managers or above and the rest to be associates. In fact, only one-third of the respondents were executives and managers, while fully two-thirds were associates. Given this fact, one is tempted to conclude that executives see the results of TQM with rosy

glasses.

These results can only be counted as indicative, since there are no numerical data supporting the opinions voiced.

Ernst & Young Survey

The Ernst & Young Survey (1991) was sponsored by the American Quality Foundation which had been launched by the American Society for Quality (ASQ). However, the foundation was dissolved by ASQ in December 1994.

The survey does not address the financial benefit of quality in any reported measure. The question that came closest was, “How often does senior management evaluate information regarding the business consequence of quality performance; that is, gains in market share or profit resulting from quality improvements?” (American Quality Foundation et al., 1991, p. 16).

Easton and Jarrell (1997) are very critical of this survey on several counts. They are quite correct in that the “research methodology and sampling procedure are only vaguely described and no statistical analysis of the results are reported” (p. 16). There is a great deal of description concerning the design of the questionnaire, but the section on sample design covers only two short paragraphs on 37 of the Ernst & Young

report (1991). These define some industries but no definition of the sampling frame is given. There is no mention of whether a random sample was drawn, or if judgement sampling (as opposed to random stratified sampling) was used. The implications are quite clear that Ernst & Young used a judgement sample.

Ernst & Young (1991) state, “Each questionnaire was completed by several individuals in each organization” (p. 38). It was not clear whether a single questionnaire completed by several people was returned, or if each person returned a separate questionnaire. The document does not show the instructions or a sample questionnaire. Instead, an appendix, called “Assessment Areas,” is included. Thus one does not know whether the questions were open ended, scaled, or multiple choice.

Apparently, some of the questions from banking and health care organizations were *excluded* from the results, because of industry differences. Yet, Ernst & Young assures the reader that does not significantly alter the results.

This survey has had wide distribution and publicity. When it is used in decision making, one hopes that the decision makers read it with the care that it deserve, based on its methodological flaws..

PIMS Study

Professor Buzzell and Dr. Gale (1987) used a data base of 450 companies, consisting of 3,000 business units, to study the relationship between market strategy and performance. *PIMS* stands for Profit Impact of Market Strategy. Buzzell and Gale (1987) distinguish between "customer perceived" and "conformance" quality (p. 103). *Perceived quality* is the customers' view of quality. On the other hand, *conformance quality* is an internal measure on products or services employed to see how well the product conforms the requirements of design (p. 103). They state that, "a company uninstructed in the importance of relative perceived quality might struggle to emulate the Japanese. . . ." (p. 103). This is precisely the point of the Shewhart (or some call it the Deming) Cycle. Perhaps a better expression of this is the Deming Flow Chart (see figure 5 in Chapter 1). Buzzell and Gale (1987) apparently are not aware of this, since they list Deming as one of the quality experts that, "focused so much attention on the internal, operations view of quality" (p. 118).

Buzzell and Gale (1987) describe their method of assessing relative quality on 105 of their book. Essentially they take a "multi-functional team of managers and staff specialists" through an exercise which describes the characteristics that make the product or service saleable. The team then assigns a set of weights to each characteristic,

and they use this information to rate both their own product line and those of their leading competitors. In a way, this is not unlike the evaluation of the main matrix in a Quality Function Deployment project. The authors note that these judgmental values are verified by comparison to published data or through the use of surveys. Where the external data indicate revision is needed, they are revised.

The database showed that not only do Return on Sales (ROS) and Return on Investment (ROI) increase as Relative Quality increases, but higher quality accrues the benefit of "stronger customer loyalty; more repeat purchases; less vulnerability to price wars; ability to command higher relative price without affecting share; lower marketing costs; and share improvements." (p. 107-108).

Based on the data shown on 107 of Buzell and Gale (1987), firms with an inferior Relative Quality (index of 20 or less) have an ROS of about 7 and an ROI of about 15. However, firms with superior perceived quality (index of 80 or more) have an ROS of about 14 and an ROI of about 33. The numbers quoted are approximate readings from the graphic exhibit 6-2 on 107 of Buzzell and Gale (1987). From this it, can be concluded that moving from inferior perceived to superior perceived quality can produce as much as much as a two to one advantage on critical indicators of organizational performance.

Buzzell and Gale (1987, p. 108) state that, “together, relative market share and relative quality exert a strong influence on business profitability.” However, of the two factors, “the PIMS data show the *quality affects relative price*; but separated from quality, share has little effect on price” (italics in original). Little wonder that they titled their chapter 6, “Quality Is King.”

One interesting point is that Buzzell and Gale (1987) warn that the quality advantage can erode if a leading company allows their quality efforts to decline, or alternatively, as others in the market place eventually surpass the leading company. This is a powerful argument for continual, never ending improvement.

The MSI Study

Another study, conducted by the Market Science Institute of Swedish Organizations, confirms the major findings of the PIMS study. Using the Swedish Customer Satisfaction Barometer (SCSB), cared for by both the National Quality Research Center (NQRC) at the University of Michigan Business School and the Center for Studies of Quality and Productivity at the Stockholm School of Economics, Anderson, Fornell and Lehmann (1993) came to very similar conclusions to those of Buzzell and Gale (1987).

Anderson, et al. (1993) arrived at four key findings in their report summary:

(1) "Quality has a positive impact on customer satisfaction, and, in turn on profitability";
(2) "Increasing market share may actually lead to lower customer satisfaction";
(3) "The market's expectation of a firm's output positively affects overall satisfaction"; and
(4) "The marketplace's expectations of the quality of a firm's output changes slowly over time."

The concept of a possible *negative* relationship between market share and customer satisfaction is based on the notion of a "dilution" of service and quality as the market share expands (Lehr et al., 1993). Firms that are expanding their market share must be careful to avoid this problem.

Easton & Jarrell Review of Papers

Easton and Jarrell (1997) made an assessment of a number of academic papers that looked at the financial benefits derived from TQM. Among the issues they discussed were the basic problem of just what constitutes the acceptance or practice of TQM. If one is to compare the determination of financial benefit of TQM, one first needs to examine firms that practice TQM and compare them to those that do not practice TQM. Ideally, one would want to compare the same firm *with and without* the

practice of TQM. Since that is not possible, it is necessary to compare samples of firms with TQM in place to those without.

There are several problems associated with this. Since there is no single definition of what constitutes TQM, one needs an operational definition of TQM. Easton and Jarrell (1997) found that there are basically four such definitions used in the literature. These four are,

(1) “public announcements”;
(2) “surveys”;
(3) “third party assessment”; or
(4) “in-depth interviews” (p. 5).

Public Announcements

Easton and Jarrell (1997) show that the basic problem with public announcements is how TQM is interpreted by different managers. Companies that announce themselves as practicing TQM may be in fact using only a few of the tools, and even these may not be fully deployed throughout the organization (p. 6).

Surveys

Surveys also suffer from the respondent’s interpretation of what constitutes TQM. Another problem is that the structure of the questionnaire can lead to an unconscious bias. For instance, Lawler,

Mohrman, and Ledford (1995) reported on three surveys conducted over the period between 1987 and 1993. In the last survey, performed in 1993, they decided to extend their research from only employee involvement to both employee involvement and TQM. Question three, under their Total Quality Management section asks, “When did your quality start in relation to your employee involvement activities?” and gives three choices:

(1) “Employee involvement started first”;
(2) “Both started simultaneously”; and
(3) “Quality improvement programs started first” (p. 163).

The built in assumption is that people do not have TQM without employee involvement (EI). One can imagine a manager trying to answer this question if they do not have, or do not consider that they have, EI. Questions of this type contribute to higher non-response rates.

In describing their study method, Lawler et al. (1995) reproduced a glossary of terms that accompanied the survey (p. 171 -173). While this glossary deals with EI issues, it gives *no* definition of TQM, nor does it cover the TQM methods mentioned in the questionnaire. A further problem is that the survey does not mention to what title in the organization they mailed the questionnaire. The letter that went with the questionnaire does not say who they would prefer to answer the questionnaire. From the initial question one gets the impression that the questionnaire was intended for CEO’s or Senior Human Resource

Management. There is no distribution of the respondents by title although this was the first question of the survey. It is possible that the respondents had bias for, or against, certain procedures. It is also possible that the respondents had their own agendas influencing their responses.

Given these areas of questionability, as well as the fact that there is no report about non-respondents, the statistical calculations using Multivariate methods, such as factor analysis and regression analysis, seem highly questionable.

Third-Party Assessment

Easton and Jarrell (1997) discuss a series of problems with third party assessments. Third party assessments are such forms of recognition as:

- Supplier quality awards,
- ISO 9000 certification, and
- The Malcolm Baldrige National Quality Award.

To be useful Easton and Jarrell give five conditions:

(1) TQM (as opposed to a tool or method) must be deployed in the organization,
(2) the independence of the rating organization,
(3) the rating should not be based on financial performance,
(4) that there be no variation in the application of the rating method, and
(5) that sufficient companies are rated in enough industries to make this method useable (p. 9).

The latter condition allows for better quantitative analysis. However, it should be possible, given a proper structure, to gain as much insight with a qualitative data analysis. Easton and Jarrell (1997) then go on to state, “Unfortunately, no third-party evaluation exists that meet all of these criteria” (p.9).

In-Depth Interview

This method requires a researcher that is skilled in determining whether a company is truly using TQM or not given an operational definition of TQM. The researcher starts with a list of potential firms that claim that they are using TQM, and he/she interviews key people in those organizations to establish:

- that they match the criteria,
- that they have employed the method a reasonable period of time, and
- that the method is fully deployed in the organization.

Apparently, only one paper used this method. Easton and Jarrell (1998) used a process of interviews to narrow down an initial sample of over 500 firms to 108 “event firms”. Such event firms qualified as practicing TQM by using the MBNQA standards as an operational definition of TQM. It should be noted that Professor Easton was a Senior MBNQA examiner, and as such, he was very qualified to determine if a

firm was in fact following the MBNQA criterion in depth.

In their section labeled “Conclusion”, Easton and Jarrell (1997, p. 40) discuss the nine papers they reviewed which measured “corporate performance using externally available financial data.” In all cases but one, positive performance due to TQM was reported. The one paper that failed to detect a positive performance examined “ stock price reaction to ISO 9000 registration (Anderson, Daly and Johnson, 1995).

The fact that no detectable change was observed by Anderson, et al does not surprise this writer. ISO 9000 is an inspection oriented system focusing on conformance to specifications, rather than on continual improvement. Conformance maintains the *status quo*; it does not improve a process. ISO 9000 standards are satisfied if the output conforms to the specifications or explains why it does not conform. It does not go to the next step of improvement. That may be the reason why even the senior officials of the European Community’s Directorate-General III for Industry are reported to be questioning the value of ISO 9000 (Zuckerman, 1994).

In his book on managerial breakthroughs, Dr. Juran (1964) distinguishes between “breakthrough” (improvement) and control. The reader should understand that, as currently structured, ISO 9000 is a control system, nothing more and nothing less.

Summary of the Benefits of TQM

Those researchers that studied the impact of TQM on a firm almost *universally* conclude that TQM is beneficial to a firm's performance. This is true whether the firm is Japanese (Kano et al., 1983; Kano et al., 1990), Swedish (Lehr et al., 1993), or American (U. S. General Accounting Office, 1991; Easton et al., 1997; Hiam, 1993). Kano's (1983) study is particular interesting, since the Japanese firms that win the Deming Prize often made use of the quantitative tools of quality.

Conclusion

The literature thus has substantial documentation that TQM is beneficial to organizations. This holds true, even though a large amount of variation exists in how TQM is viewed and practiced by various organizations. However, the lack of a unified view of TQM requires that it needs to be defined in any study *before* one can properly assess other constructs.

There is a divergence of views as to what constitutes the tools and techniques of TQM. In the early period of quality control, the emphasis was on quantitative tools. Later, as Dr. Juran introduced the Managerial Breakthrough Technique and Dr. Ishikawa applied Juran's method using Japanese work groups called Quality Control Circles, more qualitative

tools were introduced. In a variation on Gresham's Law, it seems that tools which are easier to use displace those that are harder to use (Hackman et al., 1995).

The hypothesis of this study is that the displacement effect may be due to the background, training and organizational environment of the managers involved in the process of achieving quality. The actual use of tools is often in the hands of non-managerial employees. It is postulated by the writer that employees are influenced by their training, instructions and what they perceive management will accept. All of the factors that influence employees' decisions on which tool to use depends on the levels of management above them. This goes to the highest levels in the organization. It may also be related to whether the industry of the organization is in the manufacturing sector or not. The study will test these hypotheses.

CHAPTER 3

METHODOLOGY

This chapter deals with the research method that the writer used. The first part covers the approach, explaining the reasoning for using this technique. The following section details both the data-gathering method and the database of the study. Next, the writer examines the validity of the method. The writer also discusses the originality, contribution and limitations of data. The last section summarizes the research methodology.

The Approach

The two basic processes for finding information about a topic are *quantitative* and *qualitative* data analysis. Both methods present advantages and disadvantages.

Quantitative Methods Discussed

Quantitative methods are well established and have been used for many years. The basic method of quantitative analysis is the gathering of information. For data of the type required by this research, the usual process is to use a questionnaire. The coded data resulting from the

questionnaire can then be quantified and analyzed, using such tools as parametric or non-parametric tests of hypothesis. From these data, some conclusions can be drawn concerning those who actually responded to the questionnaire.

In the ordinary course of events, it is often impractical to survey *all* the members of a class. In such instances, samples are drawn from a list of eligible members, called a *frame* (Deming, 1960). Deming (1960) attributes the use of the term “frame” to Professor F. F. Stephan and explains it to be “a set of physical materials (census statistics, maps, lists, directories, records) that enables us to take hold of the universe piece by piece” (p. 9). One important aspect of the frame is that it “must cover enough of the universe to make the study worthwhile” (Deming, 1960, p. 9).

There are a number of methods of drawing the sample from the frame. Most often, the sampling units in the frame are numbered from one to *n*. A requisite amount of random numbers are chosen from a table or process that is proven random (see for instance, Kendall & Smith, 1960). Each sample unit in the frame, whose number matches a random number, is then selected for the sample. Alternative methods use *n*th sampling with a random start, replicated sample design, or replicated

sample design, using a random start for each replicate and repeating this in each zone (Deming, 1960).

Apart from replication, the sample may be stratified to reduce the sampling variation. Deming (1960, chapter 15) lists nine different methods of stratification. The choice of the sampling plan is a matter of theory, chosen to minimize the sampling variation.

After executing the sample and when the results are available, one can apply statistical tests to determine the precision and accuracy that sample data presents. The sample statistics are then used for further statistical analysis.

While sampling is often more efficient and less costly than a complete count of the frame, it can do no more than *estimate* the results that would have been obtained from a complete census of the frame. If there is a large gap between the frame and the universe, the conclusions may not be more than indicative.

Some of the problems with the frame were experienced by Lawler, Mohrman and Ledford (1995), when they tried to compare the performance of the “Fortune 1000". They discovered that their list was not fixed over time because of mergers and acquisitions, resulting in a constant flux of the frame from period to period. There is also a question

of the validity of the basic result when a survey contains a fair amount of non-response. Most of the time, a number of members of the sample do not respond to the questionnaire. The number of non-responses are usually large enough to cause concern of the validity of the data. If the non-respondents are different from the respondents, *any* conclusion based on data from the respondents is highly questionable. Deming (1950, 1960) discusses methods to overcome this problem.

Another major problem with any survey deals with *bias*. There are two types of bias, *mathematical* and *non-mathematical*. *Mathematical bias* results from how numeric values are formed from the sample data. Deming (1960, chapter 17) shows several examples of mathematical bias in his discussion of the calculation of the propagation of variance and bias that comes about in forming ratios and other data from sample results (see Table 1, p. 391 for example). *Non-mathematical* bias arises from the sample selection procedure, as well as the field work, including the questionnaire. This type of bias is very difficult to detect. Yet, it can be far more serious than the mathematical bias or sampling variation. Deming (1960) calls bias “persistent errors” and sampling variation, “random errors” (p. 62). He shows their relationship to total error as being each of two legs of a right triangle, with total error represented by the hypotenuse.

As a final problem, there are questions raised by Deming (1950, see chapter 7) as to the validity of using statistics, designed for estimation, for analytic purposes.

The study by Lawler, et al. (1995) dealt with results of Fortune 1000 companies. Neglecting the problems of non-response, the gap between the frame and the universe, and possibly the bias due to the questionnaire, is it really possible to predict the value of employee involvement and TQM to other companies from this set of surveys? By definition, the Fortune 1000 firms were large. It is not at all certain that smaller firms with different management styles would get the same results as Lawler et al. found for the Fortune 1000. Simply put, to try to predict inductively from a sample drawn from a frame to the universe that generated the frame is beyond the statistics of estimation normally used in quantitative analysis (Latzko & Saunders, 1995, p. 191-192).

Qualitative Data Analysis

Qualitative data analysis goes well beyond merely taking a small convenience sample. For the most part, one deals with a judgement sample that is carefully selected to allow analytic conclusions to be drawn. The hallmark of a qualitative data analysis is the in-depth study of the

sample selected. As a general rule, most qualitative research uses in-depth interviewing and is sensitive to the respondent's reaction to the topics covered.

Merriam (1998) differentiates between qualitative and quantitative research on nine "points of comparison" (see her Table 1.1 on p. 9). She feels that the two types of research differ on:

(1) "focus of research",
(2) "philosophical roots",
(3) "associated phrases",
(4) "goal of investigation",
(5) "design characteristics",
(6) "sample",
(7) "data collection",
(8) "mode of analysis", and
(i9 "findings".

Essentially, qualitative research delves into the "nature" or "essence" of the topic under investigation, while quantitative methods look at the topic by examining the quantity of results and comparing this to some hypothesis. The goals of the two methods differ. Merriam (1998) states that qualitative research looks for "understanding, description, discovery, meaning, and hypothesis generation [emphasis added]" (p.9). She feels that the goal of quantitative research is "prediction, control, description, confirmation, [and] hypothesis testing [emphasis added]"(p. 9) Because of the differing goals, the "design characteristics, sample, [and]

data analysis" are very different. Conversely, quantitative research tends to be more fixed, using classical statistical methods employing rigid, predetermined techniques that are required to make this type of study valid. These methods fall into a class called "Enumerative Studies" by the Dr. W. Edwards Deming (1976, p. 25). Qualitative research deals with more selective, flexible methods using judgement samples to attain insight into a process. This type of method is called an "Analytic Study" by Deming (1976, p. 26).

Merriam (1998) further distinguishes the "mode of analysis" and nature of the "findings." Qualitative designs, she maintains, are "inductive (by the researcher)", leading to "comprehensive, holistic, expansive, richly descriptive" findings. Quantitative designs, she states, are basically "deductive (by statistical methods)", leading to findings that are "precise, numerical" (p. 9).

Qualitative research is an umbrella term for a number of methods applied to find out more about a particular topic in depth. Merriam (1998) lists five major types of research. Following Merriam's (1998) taxonomy, the major types are:

(1) Basic or Generic,
(2) Ethnography,
(3) Phenomenology,

(4) Grounded Theory, and
(5) Case Study.

At times, these methods may be used in combination. She also recognizes that there are other types of research, “Tesch(1990), for example lists over forty types” (p. 5).

While quantitative methods are very useful in estimating results that would be obtained from a frame, they are not as good in using the findings for prediction. Hansen and Deming (1950) presented a paper at the International Statistics Institute (in Bern, Switzerland) as early as 1949, in which they warned that sample data had limitations in its use. They distinguished between the “...data and the uses of data”, as well as “... between a standard error of a result obtained by sampling, and the risk of making a wrong forecast” (p. 214). In his paper, “On the Use of Judgement-Samples”, Deming (1976) poses the question, “what type of problem requires, for best efficiency, use of a judgement sample . . . ?” (p. 25). He goes on to distinguish between analytic and enumerative surveys, concluding that analytic surveys require the use of judgement samples (p. 29). In fact he states, “Most of man’s knowledge in science has been learned through the use of judgement-samples and careful inference” (Deming, 1976, p. 29).

Judgement-samples seem to be appropriate for use in qualitative methods, since, as Merriam (1998, p. 9) points out, the goal of qualitative research is “understanding,...,hypothesis generating” and the method is “inductive.” Since qualitative methods are inferential, judgement-sampling seems to be the appropriate technique to use.

As in a number of qualitative research methods, Deming (1976, p. 26), speaking about judgement-sampling, recommends that “it is usually best, in fact, to investigate at the start strata at the extremes of response.” This is the type of case study that Yin (1994, p. 39) calls Type 3 or Type 4 multiple-case designs. If the strata that Deming (1976) speaks of are distributed over several organizations, Yin (1994) would call this a “holistic” or Type 3 case study. If, however, the strata are within an organization, Yin would call it an “embedded” or Type 4 case study.

Choice of Methodology

The purpose of this research is to gain an insight into the factors that determine how people select tools of quality in manufacturing and non-manufacturing situations. The hypothesis is that it depends on the background of top executives and that there is likely also a difference in the logic of selection between those in manufacturing and those in

engaged in the service industries. Since the research is dedicated to developing an understanding of these factors, it would seem that qualitative methods will give the best insight. Of the qualitative methods, the case study appears to be the method best suited to gain an understanding of the process of selection of tools of quality.

Leedy (1997, p. 109) has a table which allows the decision to be made between qualitative and quantitative research. Following this table, it is the writer's believe that "there are multiple constructed realities." In effect, there are several factors that impinge on the outcome, and the research is to give a better understanding of these constructs. According to Yin (1994) case studies are used in such areas as "organization and management studies" (p. 1). Miles and Huberman (1994) also state that "in the past decade, however, more researchers in basic disciplines and applied fields (... [such as] organizational studies, business studies...) have shifted to a more qualitative paradigm" (p.1). A number of computer programs are now available to help in analysis of verbal data. In fact, both Miles and Huberman (1994) and Kelle (1995) indicated the growth and importance of the method. It is, therefore, believed that the audience of this dissertation will be "familiar with/supportive of qualitative studies" (Leedy, 1997).

Following Leedy's (1997) table, the present research is "exploratory and interpretive." The research is designed to get at the underlying causes for the selection of tools. There is very little literature that deals with this issue. Some writers like Tamimi and Sebastianelli (1996) used their students for research that indicated that manufacturing and service industry were different, but still, these researchers did not come across any work that indicated *how* the tools for managing quality were selected. The literature is, in Leedy's (1997) terms, "limited or missing" (p. 109).

To gain the insight needed, the study must explore details that are not readily put into a structured questionnaire. It is "in-depth", rather than broad.

The writer believes that he has the skills to work with people in an unstructured way, has the requisite ability to pay attention to details, and can reason inductively. Having been in charge of market research for a major service organization, the writer believes that he has the experience required for developing and executing the requisite interviews. Since the writer has published books and refereed articles on the subject of quality, he also feels that he has the writing skills needed that fit Leedy's (1997) requirements for qualitative research.

Case Study

While a single case can give enormous insight into the study subject matter, it seems to the writer that this study must be a multi-case study, especially since two different industries and various backgrounds are involved. Following Deming's logic of using extreme strata in selecting judgement-samples, it is necessary to have at least one case with a company official having technical background, one case with a company official with a non-technical background, and a case to distinguish between manufacturing and service industries. As will be developed in the next section, the research needs to examine at least three organizations and examine areas *within* each of these organizations to develop some understanding of what factors contribute to the decision.

In terms of Yin's (1994) classification of case study designs, this indicates the use of his Type 4 design. The Type 4 design requires multiple-case design using embedded or multiple units in each case.

In terms of this research, the case is the organization involved and the multiple units are the executives and staff involved in the process of monitoring, reporting, and applying methods of quality control. The latter term is intended to include the organization's process of continual improvement.

The Data-gathering Method and Database of Study.

Miles and Huberman (1994) suggest drawing a conceptual framework to clarify and bound the research. This is the framework that seems to match the requirements for the research on the use of tools for quality.

To determine the factors that give rise to the selection of tools for the control of quality four organizational functions are concerned:

(1) the policy maker,
(2) the decision maker,
(3) support groups, and
(4) the staff.

The *policy maker* is usually the owner or chief executive officer of the firm. This person is the guiding spirit of the organization. The *decision maker* may be the policy maker or another executive charged with the running of the organization. The *support groups* are the staff functions (sometimes a person with other duties) that has responsibility for helping the decision maker achieve quality and the function that is responsible for the training of the staff in quality concepts. The *staff* consists of all levels of employees below the decision maker. They are responsible for accumulating the information needed for the reports used by the decision and policy makers. They often prepare the reports as well, although

sometimes this function may rest with the support groups. The staff, with or without the assistance of the support groups, uses local quality information and tools for the maintenance and improvement of their processes.

The proposed Tool Selection Model shown in Figure 8 on the right indicates the paths of influence that flow from the policy maker throughout the organization. The area within the dotted line shows the decision flow resulting in the tool selection.

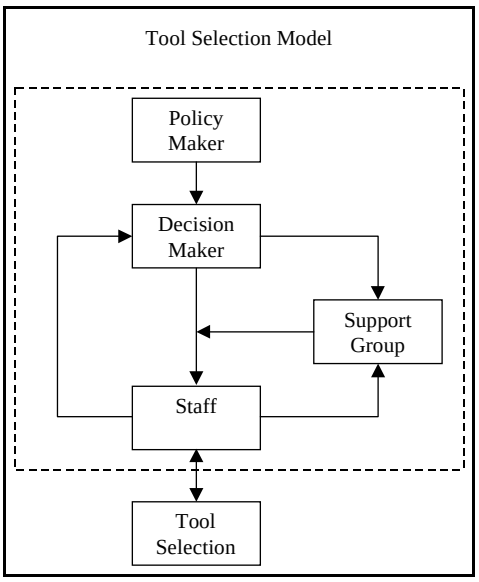

Figure 8 Decision Flow

In each activity, there are a number of additional factors that may be relevant to the behavior of each party in this activity. The hypothesis of the dissertation is that the characteristics of the Tool Selection Model is influenced by the background of the parties involved. This background includes formal education both outside and inside the organization, as well as the sociological aspects of the industry in which the organization resides (see Figure 9 below) .

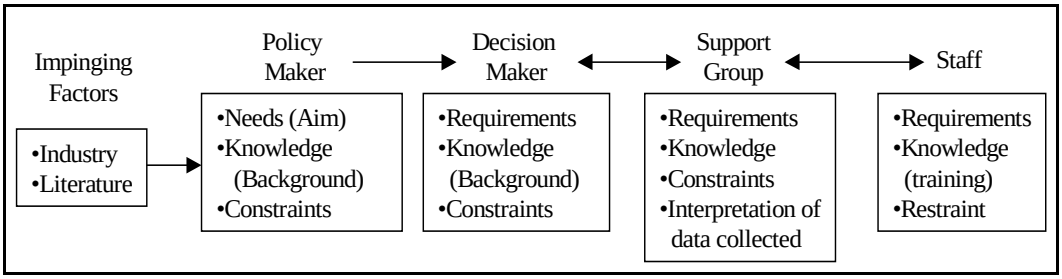

Figure 9 Conceptual framework of the Study

In a recent article, Deleryd, Deltin, and Klefsjö (1999) made a clever use of the Cause and Effect diagram to show "the critical aspects for a successful implementation of process capability studies..." (p. 43). Figure 10, below, shows the tool model as a Cause and Effect chart.

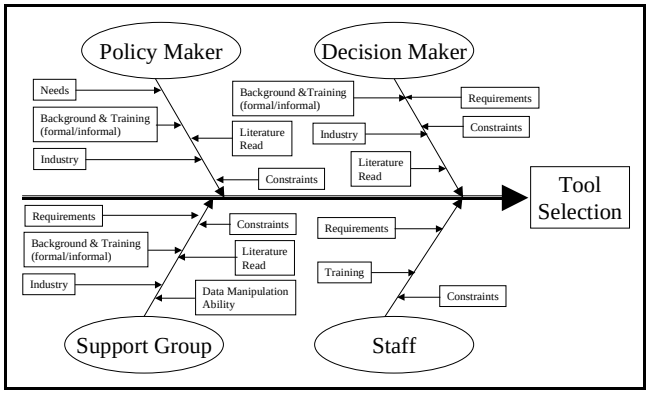

Figure 10 Tool Model - Cause and Effect View

Based on the framework above, a series of research questions arise. At this time, there is no particular order.

1. How do the different factions define TQM?
2. What does the Policy Maker consider as quality for the

organization? (If this is too broad, ask for the question in reference to a major product line.)

3. What impact does the Policy Maker think the issue of quality, as defined above, has on the performance of the organization? Is this based on perception or data?
4. How does the Policy Maker and/or the Decision Maker manage or control those activities that influence quality to make sure that the quality level is satisfactory? Are there reports that reflect the quality of the output?
5. Why did the Policy and Decision Makers chose these methods of control? What alternative methods, if any, were considered? If there were alternative methods considered, why were they rejected?
6. What is the formal and informal educational background of the members of the various organizational functions from Policy Maker to Staff? What formal TQM training did they have?
7. Who is responsible for (a) the design, (b) the implementation, and (c) use of reports for the Decision Maker?

8. When and how often are reports issued to the Decision Maker?
9. How does the Decision Maker use the reports? What actions does he or she take on the basis of the reports?
10. How does the Policy and/or Decision Maker, decide what constitutes success of the control system?

The writer feels that the response to these questions will refine the Tool Selection Model for a better understanding of the Tool Selection Process.

Sample Selection

Since banks have been used in an important past study (Adam, Hershauer, & Ruch, 1978) to represent the epitome of service organizations, the writer feels that the use of banks as part of the case study would be satisfactory in this study. In addition, the writer spent many years in the quality aspect of the banking industry, and therefore, he is very familiar with this type of industry.

The writer selected the cases to be studied from both a New York Clearing House bank, which adopted a formal quality program and a division of the Clearing House itself. The activity of the bank is often studied by other financial institutions, and in fact, their methods are

frequently copied by the other institutions. Therefore, it is felt that the New York Clearinghouse Bank represents a type of organization that is suitable for a study such as the one proposed.

To verify the results, the writer included a hospital in the service category for interviews. This hospital has received awards for quality from the State of New Jersey and is used as a role model for quality by other national organizations.

The writer also had the opportunity to include an organization that straddles the service and manufacturing lines. By interviewing several departments in the New York MTA Metro-North railway, the writer encountered a group that has extensive maintenance, construction and service operations. This group also has a formal quality control system.

For a manufacturer, the writer used a manufacturer of cardboard containers ranging from plain brown boxes to highly decorated display containers. Again, the writer has worked with this manufacturer and is reasonably familiar with its quality program as well as the manufacturing process itself.

An additional insight was gained by interviewing the owner of a very small manufacturer in the embroidery business. This manufacturer is the employer of less than 20 people. It was felt that using such a small

business unit could add to the understanding of how quality systems work for small business units.

Research Design Summary

Following Yin's (1994) methodology, the research design can be summarized as follows:

The study questions are:

(1) how and why do executives choose the tools for quality measurement that they employ and

(b) is this choice different for service and manufacturing segments.

The study propositions are:

(1) executive background influences their decision, and

(2) others, such as staff personnel and workers, are influenced by the executive's actual or perceived signals of which tool to use.

The units of analysis are banks and a manufacturer. Within these organizations interviews need to be conducted with

(1) the Policy Maker,

(2) the Decision maker (if different from the Policy Maker),

(3) the Staff Personnel responsible for quality measurement,

(4) the data gatherers and preparers.

It is proposed to link the data to the propositions by searching for patterns in the statements made by the various units of analysis.

The criteria for interpreting the findings are contingent on the results of the interviews. Even, if patterns from the interviews match the propositions, i.e. that there is an apparent relationship between the executive's background and the choice of tools a sample of three cases, this can only be *indicative*. The main contribution is the development, through detailed analysis of the three cases, that the hypothesized relationship has a *potential* basis in fact, and that further research will indeed be worthwhile. It is possible that the in-depth research conducted here will lead to additional hypotheses, ultimately yielding a greater understanding of the mechanism involved in the selection of tools for TQM.

The Validity of Data.

According to Merriam (1998, p. 199):

> "It [is] imperative that researchers and others have confidence in the conduct of the investigation and in the results of any particular study. Assessing the validity and reliability of a qualitative study involves examining its component parts."

Yin (1994, p.33-34) distinguishes four "criteria for judging the

quality of research designs." These are:

(1) construct validity,
(2) internal validity,
(3) external validity, and
(4) reliability.

Construct Validity

Yin (1994) defines construct validity as "establishing correct operational measures for the concepts being studied." For the operational measures of the study, the writer chose two measures:

(1) the educational background of the executive; and

(2) the material read by the executive.

For the educational background, the measures include *formal education* (with degrees earned) and *informal education* (such as courses, seminars, and other studies related to the topic of quality that may or may not result in a certificate.)

The second measure deals with the material that the executive reads (such as books, articles, study tapes, briefing reports, and the like) that deal with quality. The degree of influence that these constructs have on the decision of which tools to use is the subject of the study.

Internal Validity

Merriam (1998, p. 201) defines internal validity as dealing "with the

question of how research findings match reality." She then goes on to state that in qualitative research, reality "is not a single, fixed, objective phenomenon waiting to be discovered, observed, and measured as in quantitative research" (p. 202). She goes on to state, "what is being observed are people's constructions of reality–how they understand the world" (p. 203).

Yin (1994, p. 33) defines internal validity "(for explanatory or causal studies only, and not for descriptive or exploratory studies): establishing a causal relationship, whereby certain conditions are shown to lead to other conditions, as distinguished from spurious relationships."

Among the several methods to develop internal validity that are discussed by Merriam (1998) and Yin (1994) is "triangulation." In this method, multiple sources of data are used together to develop a fact (Yin, 1994, p. 91-93; Merriam, 1998, p. 204). In this study, not only are service units contrasted with manufacturers, but internally, three or four groups of people are interviewed. The outcomes of all of these interviews are collated to converge on the behavior of the constructs, in relation to the study proposition.

External Validity

Merriam (1998, p. 207) defines external validity as being "concerned with the extent to which the findings of one study can be applied to other situations." Yin (1994, p. 33) defines external validity as "Establishing the domain to which a studies findings can be generalized."

In discussing external validity, Yin (1994, p. 36) makes an important comment,

> Critics typically state that single cases offer a poor basis for generalizing. However, such critics are implicitly contrasting the situation to survey research, in which a "sample" (if selected correctly) readily generalizes to a larger universe. *This analogy to samples and universes is incorrect when dealing with case studies.* This is because survey research relies on *statistical* generalization, whereas case studies (as with experiments) rely on *analytical* generalization. In analytical generalization, the investigator is striving to generalize a particular set of results to some broader theory.

The ability to make analytical generalizations about service applications by using banks has been tested before. The writer has applied the methods developed by Adam, et al. (1978) to other service industries (insurance, logistics, academia), as well as to administrative components in manufacturing (sales, accounting). In sum, he found the method to be completely transferable. This makes it appear that generalizations that are derived from banks are indeed representative of

other service operations.

Reliability

Merriam (1998, p. 205) states that “reliability refers to the extent to which findings can be replicated. In other words, if the study is repeated will it yield the same results.” Yin (1994, p. 36) adds this caveat, “Note that the emphasis is on doing the *same* case over again, not on ‘replicating’ the results of one case by doing *another* case study.”

A prerequisite to reliability as Yin (1994) points out is the necessity for documenting the procedures followed. To this end, a set of discussion topics has been developed for the guidance of the interviewer. These questions, based on the issues considered above, are shown in Appendix C. These questions, together with the case study protocol and the notes that will be developed as the study progresses, will become the basis for an audit trail that details the work and conclusions in the next chapters.

The Originality and Limitations of Data

After an extensive literature search, the writer feels reasonably confident that the selection of quality measuring tools has not been treated before and that this study breaks new ground. In fact, there is not

much written that gives guidance to the topic of how to select which tool to use for the measurement of quality.

By utilizing an embedded multiple-case study design in an area in which the writer has considerable background and experience, it is expected that new insights will be gained that will aid in determining how managers select the tools of quality best suited to them.

The data consist of the interviews conducted to establish such links with the propositions as are revealed by the data. These data are gathered from primary sources.

Contributions of this Study

As part of this study, a detailed analysis is made of what is meant by the term Total Quality Management (TQM). Through the use of content analysis of a large number of definitions, a general concept is formed. Additionally, a review of the various tools available for measuring and improving processes resulted in a taxonomy of these tools. Using these two results, it is now possible to investigate the primary hypotheses that the tool selection depends on the background of the Policy and/or Decision Maker and that the decision differs between the manufacturing and service sectors. Since there appears to be no research in this area, a

series of three case studies will provide a rich description of how such tools are selected in specific applications. These case studies will also test the instrument that can be used to make further investigations.

Limitations of the Study

A basic limitation in a case study concerns the researcher. It is the researcher who asks the questions and analyzes the responses. It is always possible that the writer, as the researcher, has biases of which he is not even aware. Such biases could slant both the data gathering phase and the analysis phase of the study.

Another limitation is that the researcher will be working alone on this research. Although the researcher has much experience in the field of quality and has interviewed respondents in the past, the researcher has not performed a case study before.

Access to good research subjects is also a limitation. Executives in the targeted organizations have their own agendas, and as such, they may respond with what they think is a “correct” reply, rather than a factual answer.

Summary of Chapter 3.

To answer the questions of how and why executives choose the tools for quality measurement that they employ, and whether this choice different for service and manufacturing segments, the writer chose to perform a multiple embedded case study. After considering the options of using quantitative or qualitative research methods, the writer opted for the qualitative methods. It is felt that since very little is known on the topic under review, a rich, in-depth study would yield more detailed G163

results than could be obtained with quantitative methods. In effect, the study looks more to generating hypotheses than to testing them at this time.

The research design was discussed, in this chapter, considering the issues of validity and reliability. The limitations of the research were outlined as well, as was the originality of this research.

CHAPTER 4

DATA ANALYSIS

This chapter develops the results of the survey. It describes the results of the interviews and discloses the findings based on the interviews. In order to set the stage for understanding the results, a brief description is made of the business units that were surveyed and the people included in the survey. From this base, the findings are organized by the topics surveyed. Although the study was not a grounded theory type of study, the need for some modification of the hypotheses became apparent.

The description of the people interviewed includes the background of each person based on their formal and informal education with regard to achieving quality. In addition, the writer asked about their source of information about quality issues by asking the media they use for this purpose.

Some interviews followed the outline generated by the writer while others tended to range over the subject matter in a nearly random manner based on the interests of the respondent. Since the objective was to obtain data, the writer allowed the interviews to range a bit as long as the main topics were covered.

Every respondent was given a copy of the writer's basic questions in advance of the interview so that they had a chance to think about the topics and thus keep the interviews within reasonable time limits. In addition, each respondent received a one page summary of the purpose of the survey as well as a basic outline of the model on which the survey was based. Most interviews lasted about one hour, with a range of plus or minus one quarter hour.

Every respondent agreed to letting the writer record the interviews. Because the writer was not sure whether the recoding equipment would operate in every instance, the writer also took copious notes. As it turned out, some of the early interviews picked-up a very distracting secondary signal so that the taking of notes was of great significance.

The rest of this chapter is organized in order of completion of the interviews.

Bank of New York

The Bank of New York is a major money center bank. The retail banking portion of the Holding Company alone has over 300 branches in three states. It is a major retail bank with assets of over 14 billion dollars. The business unit chosen for the study was the operations portion of the bank. This is the part of the organization responsible for activities such as

the transfer of funds, checks processing, corporate trust functions and the like. Even though there is a large use made of computers, the activities of this business unit are heavily labor dependent.

People Interviewed at the Bank of New York

The three people interviewed for the Bank of New York were

1. Mr. Donald R. Monks, Senior Executive Vice President, Operations and Technology;
2. Mr. Ciro J. Vitiello, Senior Vice President, Bank Operations Group; and
3. Mr. Steven D. Thum, Vice President and Manager of the Office of Quality Assurance.

It should be noted that the writer had hired Mr. Monks and Mr. Thum when the writer was the officer in charge of quality at the Irving Trust Company. Mr. Vitiello also worked in the writer's department at one time.

In terms of the study, Mr. Monks is the Policy and Decision Maker in the operation studied. He reports to the chairman of the bank. In terms of formal schooling, Mr. Monks holds a B.S. in Business Administration from Ryder University and a MA in Economics from the University of

Delaware. He had a 2-day course with Dr. Deming and attended “a couple of Quality Control Annual Conferences, two of them in the early 70's, one in Boston and one in Toronto.” Mr. Monks gets his business information primarily from the American Bankers Association Journals and business newspapers.

Mr. Vitiello reports to Mr. Monks. He holds a B.S. in Accounting from Long Island University. He also took a course called Business of Banking from the American Bankers Association. Mr. Vitiello gets his main source of business information from the American Banker and trade journals.

Mr. Thum also reports to Mr. Monks although he has bank-wide responsibilities. He holds a BA in statistics from Princeton University. In addition he had a one week seminar in sample theory given by Dr. Deming and had a week of Dr. Juran’s course on the Management of Quality. He gets his information about quality mostly from the Clemson University Internet site known as the Deming Electronic Network (den.list@deming.ces.clemson.edu), a form of list-serve application that has about 400 subscribers who exchange views about quality issues. At the time he also received *Quality Progress*, the technical journal of the American Society for Quality. His main sources are technology trade

journals such as *Bank Systems & Equipment* and Imaging. In addition he reads *The Wall Street Journal.*

View of TQM

TQM was viewed differently by the three people interviewed. Mr. Monks defined TQM as follows:

> I guess TQM to me means a series of measurements or indicators of quality in a holistic sense. Which means statistical support for qualitative measures that show performance in the same direction. What I'm saying is that it has to have some quantification but also has to fit that in kind of a common sense test of business practices.

Mr. Vitiello stated that to him it means, "a program that encompasses, obviously, accuracy and assists service functions to achieve a smooth workflow and productivity."

Mr. Thum defined TQM as "the process of insuring that the products and services meet and exceed what customers expect." He went on to define needs as the customer's basic minimum requirements.

Apparently, senior management looks upon TQM as an outcome, a measurement of quality while the user and staff look upon it as a method.

View of Quality

Their view of quality is more aligned. Mr. Monks as senior management, considers quality of products to mean, "that customer

service is adequate to meet a realistic customer expectation at this level of cost, quality cost in delivering that, in other words, it can be produced consistently on a first try basis." Mr. Vitiello, the user, said, "quality means delivering a product with high accuracy rate, a resolution of any problems that might occur." Mr. Thum, as staff, thought that, "Quality depends on the product. It consists of time-lines and accuracy, as well as ease of use and ability to give the customer what he needs." While all three saw the inclusion of the customer in their view of quality, they modified this in different ways. Senior management spoke of "realistic customer expectations' and costs, the user spoke of complaints (presumably the absence of quality), while the staff looks at the customer's needs as opposed to expectations.

The Need For Quality

All three looked upon the need for quality as arising out of competition, that the industry gives the customer choices of organizations that they can use. From the policy maker's view (Mr. Monks) one value of achieving quality is "customer loyalty." Another aspect is, as Mr. Monks stated,

> that since in this business you pay for your mistakes, I have to keep an eye on what the cost of failure is. And, I don't mean the

> cost of doing it over, I mean the cost of external failure. I make the payment incorrectly, it costs me millions, and I've been paid a $1.65 for the transaction.

This view coincides with Mr. Vitiello's use of "resolution of any problems that might occur, in his definition of quality.

Type of Reports Used

All three respondents rely on numeric reports that are basically developed by the departmental users to control that they are meeting the requirements of timeliness and accuracy. They rely on their own subjective views to distinguish between variations that are significant from those that are normal to the system. When asked how he distinguishes a significant change from a non-significant change, Mr. Monks thought that it "was a good question." When asked what amount of change in the incident of errors would be considered significant enough to trigger action, he stated, "I would say a 15% increase in the number of errors [would trigger action]."

Since a control chart can separate the common causes from special (significant) causes, the writer asked Mr. Monks about the use of control charts. Specifically, the question was "why the choice of not using control charts. Is the control chart too difficult to use? What are the

negatives that causes it not to be used?" His response was,

> I would say that at my level, the tendency is to look at the total performance for the past month in terms of numbers of problems of certain type that had occurred in the past month and just plotting those along, rather than the kind of variability of . . . , the data has come to be pretty consistent and flat. So we tend to look at the trending of that data.

Mr. Vitiello thought that control charts were "pretty basic stuff." He does not use these charts and apparently depends on another department in the bank to convert the raw data of his reports to graphics. He indicated that "Some clients want a report that compares our data against their requirements. They sometimes get numeric, sometimes graphic reports."

Mr. Thum mainly uses bar charts when reporting data to customers. These charts generally show a standard of performance such as 95 % line for "Non-Routine Security Transfers Processed Within Five Days." A line is drawn at the standard of performance percentage. When a variable standard is involved, such as the average speed of answering a call within 30 seconds, he uses a line chart showing weekly averages plotted. In neither case is the natural variation considered. Only arithmetic means are used. The variance is not shown.

Determinants of Quality Standards

Quality levels are determined by industry standards or customer demands. Mr Thum indicated that the levels are driven by competition. This was also the response from Mr. Monks and Mr. Vitiello. The bank uses third party surveys to measure customer satisfaction such as ABA Cooperative Studies. In addition, Mr. Vitiello said, “Generally we get feedback on how other banks are doing when we go out and make customer calls. You may get customers that give you informal feedback.”

Quality Tools

Of the quality tools known, Mr. Thum was the most conversant since he uses a number of them. In addition to the control chart which we discussed, he uses basically Ishikawa’s seven tools of quality in his work. Both Mr. Monks and Mr. Vitiello said that they used brainstorming. Mr. Monks wrapped it up when he stated,

> I think we have well-developed quality programs in some areas and not in others. In the whole area of bank operations we have been doing it for a long time. [In some areas] the whole management process is not well developed and therefore, the monitoring process that management uses is not well developed.

The operations and technology area, all three respondents thought was matured and had a good quality program in operation.

New York Clearing House - Electronic Payment Network

The New York Clearing House is composed of 9 member banks in New York. On its web site, www.nych.org, the organization gives the following description of its function:

> The New York Clearing House Association L.L.C. is the nation's first and largest bank clearing house. From its beginnings in 1853, the Clearing House has played a variety of key roles supporting the development of the banking system in the nation's financial center. Its first function was to bring order out of the chaotic exchange and settlement process among the banks of New York City. Later, and until the Federal Reserve System was established in 1913, the Clearing House served to stabilize fluctuations in the monetary system and carry it through recurring panics. In 1970, the Clearing House Interbank Payments System (CHIPS) began operations, substituting electronic transmissions for paper checks in international dollar payments. Five years later, the Electronic Payments Network (EPN) was formed to process payments electronically among domestic financial institutions in the Second Federal Reserve District. In 1992, the Clearing House launched the Clearing House Electronic Check Clearing System (CHECCS) to aid in the exchange of checks and the prevention of check fraud.

The Electronic Payments Network (EPN) requires a computer system that operates with essentially no downtime. To accomplish that feat, a redundant system is used. Quality in this organization depends on the rapid switching to the stand-by system in case a problem develops. This in turn requires continual monitoring of the process.

People Interviewed

Three people were interviewed at EPN. The official title of this organization is “The Clearing House Service Company.”

1. Mr. George F Thomas, Senior Vice President, Director of Information Services,
2. Mr. Rick Plummer, Vice president, Computer Operations, and
3. Mr. Jose B. Molina, Manager, Quality Control

Mr. Thomas reports to Mr. John Mohr, Executive Vice President of the New York Clearing House. Mr. Thomas studied for 2 years at Adelphi University as a Business Major. In addition, he holds a Management Certificate from the New York State Banking Association. He attended management type seminars and also is Certified ACH AAP. When asked if he attended any seminars on quality, he stated:

> Not specifically. I have my own definition of what Total Quality means. At a level where we think that we are just about this close to perfection, we may not need any formal training, we just haven’t [had any. It has not] really come up as an issue.

In terms of acquisition of information concerning quality, Mr. Thomas said that he reads “Trade Publications, Computer World and those types of things.”

Mr. Plummer reports to Mr. Thomas. He said that he has “been in this business since ‘70, with computers, programming them and operating them.” After graduation from high school he attended New York University for a semester but could not finish because he went into the Navy. He has had no other seminars or training. However, once a year he attends a Computer Operations Management Association meeting. As he stated, “to keep up-to-date on the latest ideas.” Mr. Plummer does not utilize any media preferring to learn “from experience.”

Mr. Molina, Manager of Quality Control, reports to Mr. Plummer. He holds a B.S. in Computer Science from Hunter. He has extensive seminar training having attended AMA Courses both technical and 8 management classes, UNISYS Technical Program, Crosby Quality Assurance Institute, as well as in-house training. He gets his basic information from *American Banker* and *PC World*.

View of TQM

Mr. Thomas defined Total Quality Management as “the goal of continually improving quality loss of services for internal and external customers, and then try to get everyone in the organization to have that philosophy.” Mr. Plummer’s view of TQM was succinct. He defined it as

the “constant paying attention to details.” Mr. Molina’s definition seemed to be based on his job content, “the administration of project plans, e.g. testing guided by guidelines and rules.”

All three respondents reflected the view that TQM was the application of the method that they use to ascertain that the computer programs have as few problems as possible. They look upon TQM as a tool to assure product integrity. They are, apparently, not concerned with the effects over time or process. Based on their interviews, their orientation is entirely based on the inspection of the product. This they have refined to an art. Mr. Plummer indicated that auditors that are used to other operations are amazed at the refinement of their testing process and the controls that the Clearing House uses.

View of Quality

Mr. Thomas stated that to him quality is a goal of, “100% availability and 100% accuracy. Any bug that is found [after installation], to me, is a personal affront. These guys will tell you that one of their motivators is not to see me jump up and down.” Mr. Plummer clearly shares this view with Mr. Thomas. Mr. Plummer’s definition of quality is that “you have to keep the machines running on time, keep it up and keep it accurate.” Again, Mr. Molina is also in alignment with his bosses when he states, “Quality is

what you strive for. The end result is ideal performance based on need. Once you achieve such a performance, you come up with a product."

Type of Reports Used

The reports used consist mostly of performance reports that detail the amount of up-time that exists in the processing. Since the various payment systems are computer driven, up-time is an essential ingredient in the processing of electronic payment processing. Mr. Plummer stated, "You don't stay in business without a quality product. Especially, in this Funds Transfer Business, where seconds are dollars, not minutes. It is important to keep those machines running all the time." He then went on to explain, "[For] the Annual Clearing House Bonus, should it be awarded, the most heavily weighted parameter, that the banks use, is the up-time of our products. We have a benchmark of 99.9[%] and we have never been that low."

The monthly Performance Statistics Report shows that the up-time of the system was well within the guidelines set for the bonus. Yet, the bonus did not seem to be the driving force. Mr. Plummer explained that maintaining quality is more related to pride of workmanship than the bonus. He stated,

> [Quality is a] source of pride more than anything else. Because, we are here to provide a service to the banks. We could provide a much lesser quality product and survive. Therefore, what drives us? It is pride more than anything else, in accomplishing in doing the best possible job we can do. There is no financial reward to be at 100% versus 99.9% for the year. We could be down an hour and still make 99.9% over the course of a year. There is no financial difference, it is just a matter of pride of workmanship.

Mr. Molina was more concerned with the product testing than long term reports. When asked how the Clearing House determines that its quality standards are met, he said, “Measure the test results. Examine resources of the testing and how effectively one utilized the resources. Success of a project can be rated in this way.”

The Need for Quality

There is a strong regard for customer satisfaction. An annual survey of the banks, serviced by EPN, explores such areas as cost, support, education and documentation. Each factor is rated on a scale of 1 (worst) to 5 (best). The results are reported by component factors and by an overall “Quality of Service” score. The overall score appears to be most important. Mr. Thomas said, “Our goal for CHIPS is 4.5 out of 5 rating for service quality and our goal for ACH is 4.4 service quality. Any 3's or 2's that we get, we call. We look for comments on the forms but if they don’t give us a comment, we call and ask why they gave us that

rating."

Mr. Plummer also referred to the annual customer survey. When asked if he ever gets complaints from customers he stated, "Yes, and George will assign whatever manager [is involved to] call the bank to find out the details, and again, don't let anything happen twice."

In discussing the value of their quality effort, Mr. Thomas said,

> We have an excellent reputation for delivering a quality product. One of the things that the [member] banks have always said to us is that they would like to be able to do implementations the way we do them. All of our major implementations have gone in without any problem. And, I think it is the result of the way we test.

Mr. Plummer thought that the value of quality was to allow the workers to have pride of workmanship as reported above.

Quality Tools

Since the whole of the quality concept used by this organization was based on the testing or inspection of programs under a variety of scenarios, it was not surprising that the basic and advanced tools of quality were unknown to the management of this organization. The testing uses project books that record all requirements and the results of test performed on the software in simulated environments. When asked about quality tools, Mr. Molina referred to the project books. Mr. Plummer also

was not aware of their existence, as he said, “I’m not into it. We have found that we are doing it better.” Mr. Thomas was curious about the tools and their possible use in their organization. When some of the tools were described to him he said, “I would be curious to see how they would fit in the environment, how they could be used here.” On having this explained, he responded with, “Have you found organizations that used them?” This is the type of position that Deming called the search for examples.

Not being familiar with the tool that could show where weaknesses lie, where recurring problems exist, where special causes are lurking, no use is made of control charts. One potential application dealt with the measurements that are reported in accounting format. A control chart could tell management when explanations for special causes are needed and when the process is operating within its capability. The writer saw opportunities in this area as well as in the use of Pareto Charts and Cause and Effect analyses.

Schiffenhaus Packaging Company

Schiffenhaus Packaging Company is a speciality paper conversion manufacturer. They make shipping and display containers that range from

standard “brown boxes” (plain corrugated shipping containers named after the brown liner used) to decorated cardboard display units. The essential ingredient is their ability to make corrugated containers with or without decoration. The company is family owned with the third generation of the family as active management. Their interest in quality as a management issue stem from hearing Dr. Deming in Philadelphia and later participating in a so-called round table group sponsored by the Philadelphia Chamber of Commerce. Finding their needs to be greater than those of the round table, they worked with the writer in developing a program to achieve quality. Their success is such that while others in the container business see their business deteriorating, Schiffenhaus is so successful that they are absorbing failing container manufacturers and making them into viable companies again.

People Interviewed

The three people interviewed at Schiffenhaus Packaging Corporation were,

1. Mr. Joseph (Jodi) A. Shiffenhaus, Jr., Office of the president
2. Mr. Stephen J. Long, Vice President - Corporate Quality, and

3. Mr. Gary Natusch, Plant Superintendent.

Mr. Schiffenhaus, the policy and decision maker, shares the Office of the president with his cousin. They report to the Board of Directors which is made up of them, their fathers and some other members of the family. Mr. Schiffenhaus has two years of college at Fairleigh Dickinson College (Madison) where he studied Political Science. He is a certified Lead Assessor. Certified Lead Assessors are people who have expert knowledge of the ISO 9000 series of standards, pass an exam and serve an apprenticeship under other lead assessors before receiving their certification.

He took additional schooling with regard to quality by attending the industry Corrugation School, Dr. Deming's Four Day Seminar, and participating in the Philadelphia Council for Excellence (PACE) Round Table.

When asked about his acquisition of information related to quality, he stated, "Steve Long gets most of the quality periodicals. But we do keep an eye open for TV or magazine articles dealing with quality issues." He also added that he uses the Internet as a resource for information regarding quality. The last item mentioned was the *Productivity Magazine*. An interesting quality issue came about from this last resource. As Mr.

Schiffenhaus stated it,

> I saw in this magazine a reading program, got the name [of the company that gave the program], got the company and we started a two year program here. It costs us about $100,000. I think that it is incredulous that we are quality company, ISO company, and have people that couldn't read.

Mr. Long is the firm's original quality control director. As vice president for corporate quality, he reports directly to Mr. Schiffenhaus. He holds a B.A. in History from Hartwick College and is also a certified lead assessor.

He has extensive training in the field of quality. He also attended Dr. Deming's Four Day Course as well as courses such as ISO Lead Assessor training, Supplier Certification training, Quality Audits and Improved Performance, Quality Documentation, Manufacture and Process Controls, Dale Carnegie, Enhancing Quality Seminars.

His information about quality issues comes from quality specific media such as *Quality Progress* and *Quality Digest*. He also reads the *NYTimes*.

Mr. Gary Natusch, the Plant Superintendent, reports to Mr. Bob Hagen, VP Production. Mr. Hagen was not available and Mr. Natusch sat in for him as a user. Mr. Natusch holds a B.S. in Management from the University of Hartford. His additional training has been mostly job specific.

He completed training for ISO [9000], Bobst die cut equipment, Dale Carnegie, Langston school for corrugators. He is a member of Flexographic Technical Association (FTA) where he received Spectrophotometer training. He said that he got all of his information about quality from this training.

View of TQM

Mr. Schiffenhaus hedged on defining TQM. He was quite emphatic about it. In his own words, he said,

> Total Quality Management? I wouldn't care about Webster's definition. What it means to me is in the words, "quality" and "management". To me it means that when a management of a company is committed to quality, understands what quality is, understands the tools, what a Control chart is, what a Pareto chart is, the proper usage, what a Fishbone chart is, to have the scientific method of problem solving, from top-down, otherwise, it doesn't work.

He then went on to state his philosophy concerning the source for quality:

> In this company we have an executive committee which is [composed of] seven members, this is the front line. We made the commitment to quality, we made the commitment to ISO, to using computers and networks, what I call leveraging of information to better serve the customer's needs. If you don't do it that way, it is lost.
>
> If the president of your company can't define what a Pareto [chart] is, a Control chart, what a Fishbone [diagram] is, and how they are

> used, your company is not going to be anywhere on the road [to quality], it is just going to stumble, it is paying lip-service to quality. You have to understand about process control, that's what it is all about. It's not about individuals, it's about the process.

What makes this statement so very interesting is that the Schiffenhaus Packaging Corporation was one of two organizations that applied quality principles in a formal way to achieve improvements. Clearly, in the case of this company, the top management is not only committed to quality but is involved as well. Their involvement uses a text book understanding of how quality is achieved.

Mr. Long defined TQM along similar lines. He stated,

> [TQM is] the system that we use for managing the company. That includes everything because I don't distinguish quality from any constantly running [of] the company. It is just a system that we use like procedures, systems, meetings, schedules, that is how we run the company. My focus here is that quality is no different from accounting. It is everything that we do.

Mr. Natusch approached the question of TQM from the operator's point of view. He stated,

> As far as I see the total quality management for us in Schiffenhaus is that we are basically ISO. We manage our quality by ISO. Which is to say, write it down and follow through with it. You document and you have your procedures, work instructions, so I would have to say that that is quality management.

The company takes its lead from its management. In this company there are several knowledgeable champions in position of power. This

makes it easy to introduce the methodology required to continually improve. The effectiveness of using management methods designed to obtain quality can be seen in the statement by Mr. Schiffenhaus when he said, “When you came here [referring to the writer’s work with the company in 1992], we were doing 300 million square feet, in the last three years we have done 600 million square feet with the same amount of people.”

View of Quality

All three respondents from this company identified quality as something required by the customer. Mr. Schiffenhaus stated, “Quality is providing services or products to your customer that is free from defect, as free from defect as your process allows.” It is interesting to note that he understands the role of process in this definition.

Mr. Long defined quality not only in terms of the customer but also in terms of the worker. He stated,

> In a nutshell, [quality means] providing the goods and services that meet or exceeds our customers’ needs or wants. We talk of quality as a way of life, everything you do is to try and make things a little bit better. So, even though you are focused on the customer, [that is not always the purpose] it may be just trying to make the [worker’s] job easier out there. It is often trying to give them a little better quality of life.

He illustrated this concept with some examples. A representative example is given here,

> And interestingly, when we took over the plant in Suffern, one of the things we did was to paint the plant. The locker rooms were a disgrace. We painted all the locker rooms, fixed all the toilets, the bathroom, showers, etc. One of the guys came up to me and he said, “I can’t believe that you fixed the locker rooms before you did the offices.” I said, “Oh yeah, but you guys make the boxes!” He said, “really!”

This is typical of the attitude of the company. They are not only conscious of the positive impact that worker satisfaction has on quality, production, etc., but they go out of their way to achieve it.

Mr. Natusch looked at quality from the production point of view as his statement reflects. He said,

> I would have to say, to begin with [quality is that] the customer is totally satisfied, we have met their expectations or exceeded them. One can break it down to calipers, clean print, no fill-in, color is right on, that it is a square box, that everything squares up, that the glue is ok. It might even be service to the customer.

He, very properly, breaks the meaning down from the general involving the customer, to the particular, the measures that show that the customer’s needs were met.

The Need for Quality

The need for quality again revolves around the customer. The

angles from which this is seen differ based upon the person's job in the organization, yet have a central theme. For instance, Mr. Schiffenhaus looked at the impact that quality has on the company when he states,

> The value [of quality] is in the reduction of waste, decreases of cost to my customer My product is cheaper than anyone else so it increases sales. It's the classic thing in the book. Our market has gotten very competitive and the price of paper is going up. The people still wants their prices lower. There is so much competition, people are fighting right now for their lives. So we have to lower our costs to get to lower prices. We cannot ask the customers to bear our higher costs. Otherwise, they will find some other medium. This is price-based costing. So we have to get our costs in line. The improvement of quality, the reduction of cost, the elimination of waste to better meet that price-based costing. Quality helps you do that.

When asked whether that is something he perceived, or he had hard evidence, he responded,

> We measure the returns and allowances, the amount of waste we manufacture, Did Steve [Long] tell you that he was out in California in this plant that supplies all the [name of a major manufacturer] shoes to China. We did a pre-print there. And he said that they have a lot bonuses out there. He was talking to the guy in quality. "Ah", he said, "we did really well on our returns and allowances." Steve said, "What are they?"
>
> "0.14% what are yours?"
>
> "0.10%."
>
> "And we don't give bonuses."

Steve Long responded to this question by saying, "I think that we

couldn't exist without it [quality]. It is so ingrained in this company that it is our whole reputation. That is what our business is built on."

Gary Natusch took the view that

> Quality keeps the doors open, keeps us growing. If you have your profit, you can just recoup that right back into the company and you are keeping and up-dating your equipment. You are keeping up with the advancements in the industry. And, again you are satisfying your customers.

Type of Reports Used

The importance of using reports was reflected by Mr. Natusch when he stated, "The more informed the employees are, the more likely that they will stop bad material from going out of the door." The company uses real time reporting, reducing paperwork to a minimum. The reason for doing this is reflected in Mr Long's statement,

> [The quality] information is available to everybody all the time since it is on the computer data base. What we do have, is that we have an executive committee data base too. In that executive committee data base we will record for example our complaints, corrective action, non-conformance material reports . . .
>
> I can look at the non-conformance by supplier, by line, by components, by customers, From this we can form Pareto's from this. I will put this into Pareto's, and that's what we will use on analyzing the printing stations in the plant.

The impetus for the electronic reporting came from Mr. Schiffenhaus who said, "We do so much electronically and we are way

ahead. We need that competitive edge." He went on to explain that they have all their data on electronic files, accessible to everyone who needs it. In that way, they satisfy the ISO 9000 requirements. They can communicate with all concerned, internally and with customers.

For other reports, Mr. Schiffenhaus explained that their financial reports gives them data on returns and allowances from which they can see how they are doing with their customers.

Determinants of Quality Standards

There were different views on how the quality standards are set. From the operator's point of view the standards come from "work instructions". These Mr. Natusch thought came from the operators who work the equipment (process capability) and from the marketing. As Mr. Natusch expressed it,

> We walked it through, exactly what we do, so we could have it documented so each shift would do the same. Customer service and customers pass it onto sales, and customer service adds in the customers instructions. From the Quality Control Department's view, the standards are based on industry standards that have not varied over the years. These standards were made by organizations such as the Technical Association of the Pulp and Paper Industry (TAPPI) and the American Society for Testing and Materials (ASTM). These standards organizations set operational definitions for the standards used by the company. The standards were agreed to as meeting the producers capability and the customer's needs.

That is why Mr. Long's response to the question of how the company sets quality levels was,

> We don't "set" quality levels. We do the same things that we always have done. We will always monitor, key type [of requirements], for example, Edge Test. We monitor the number of customer complaints that we get. We set quality goals, which is part of the ISO effort. We see how we are progressing relative to that but not with [the goals] as a focus.

The "goals" to which Mr. Long referred are targets for continual improvement. Mr. Schiffenhaus explained how these were set:

> The key moment is at a management review meeting at the end of the year where Steve [Long] brings in all the pertinent information, Pareto, Control Charts, from customer complaints to non-conformance. There we set quality goals. Some quality goals, like returns and allowances, we set numeric figures. We say that we like to reduce customer complaints 20%. We look at the Pareto's of what the customers' complaints were. If they are grouped into things like corrugator, or glueing, or printing, that is where we say that is one of our major [areas of concern].

In effect, the levels of quality are based on customers' needs combined with process capability. The goals are targets that the company wishes to achieve. They are aware that for a stable process, that these aims require a fundamental change in the process, which, in turn, often requires capital investments.

Quality Tools

The concept of process and variation are well established at

Schiffenhaus and are deployed throughout the organization. When asked about the quality tools with which he is familiar and which he uses, Mr. Natusch cited an impressive array. He said:

> We create reports. We would try to see if there is variation, say on the corrugator. Then we might put together a form for [the operators] to track the variation, plus or minus 1/16th or 1/8th, until we can get the range of variation. [We use] Cause and Effect Diagrams, Check Sheets, all these tools. We will give you the graphs, the Pareto's, to inform everybody how we are doing. I'm sure that we use them all.

As might be expected, Mr. Long was very knowledgeable about the various tools of quality. He listed a number of tools that are currently in use at Schiffenhaus:

> Pareto, and we still use Control Charts, we use Histograms, Run Charts, Fishbone Diagrams, Flow charts–we flowchart everything–we still use that spreadsheet that you set up for me years ago that computes C_{pk}, we still use that.

Mr. Schiffenhaus also cited a large number of tools that are used in his company in general and which he uses himself. In response to the question of his knowledge of tools he said,

> Control charts, Pareto, cause and effect, flow charts, Ishikawa's seven tools. Flow charts are an integral part of our whole documentation for ISO. To me [ISO] is a tool, it is a tool of management which really organizes us to use these tools [of quality] better.

His understanding of these tools is exemplified by this statement:

> The fight I always have with Larry [Schiffenhaus, CEO, and his uncle] at the end of the year is that they look at a chart that Steve and Joe keep on waste. It is a control chart, yet it is not a control chart. Looking at this you should really look at a run chart. They always say, “waste is too high.” They get some average. Of course you have your control line and you have your special causes above and below, so your average is a little skewed. I say to them that you can’t look at that. If you start removing the above and below the line points, you squeeze it down, and you have to identify what the causes were. So invariably, Saturday they worked overtime and they just [processed mostly waste] on Saturday. So they had low production on Saturday and they had high waste, so obviously, your percent was going to skew here. If you eliminate those special causes, your average goes down and you see that most or all of your [observations] are within [the control limits]. You are only end up with a couple where the process [shows points outside the control limits].

The company has gone to great pains to make the tools of quality known to their employees at all levels of the company as well as in all the staff functions. Their unique reporting system allows easy access to the analyzed data and that seems to be an impetus for the organization to use these tools.

Clearly, some executives and plant personnel are not as conversant with SPC as desired. Mr Long told the writer,

> I have a complete course from TAPPI on Statistical Process Control (SPC). Because it relates to our businesses, it is applicable to us. What I said was that we would be forced to go into SPC. As soon as the executives take this course, then we will give it to the plant. So when we are all ready we will use this method.

Once again, the leadership style of Schiffenhaus is in evidence.

They lead from the top down by making sure that the top management understands the process before trying to fit it onto the staff.

Other Issues mentioned in the interview

A noteworthy comment by Mr. Long is that he sees the quality professionals not interacting sufficiently with customers. He said:

> The biggest problem that I see in our profession, to me, is that we don't sell ourselves enough to the customer. I don't mean that in a consulting way. I mean that I'm very involved with the sales guys here and you know, [I make] sales calls and going out with the sales force.

He went on to describe how at a Technical Conference there was nothing said about the customer. "There is no focus on the customer himself. I think that it is a big defect." He then went on to say:

> We should carry our message out to the customer, both internal and external. I think that Cindy, John and I are still the same key people [in quality] since we started, yet our business is double what it was four, five years ago and now that I got a new plant I have one additional new person. We help people in manufacturing.

Schiffenhaus Packaging Company is a progressive company that uses many of the tools of quality in a creative manner as exemplified by the mainstream of thinking of how to manage for quality;

Jo-Cal Embroidery

Jo-Cal Embroidery is a very small manufacturing firm. It has

several multi-head embroidery machines that make high quality patches, such as are worn on uniforms, and embroiders directly onto caps, sweatshirts, etc.

The firm employs very few people, estimated at no more than 14 in two shifts. Apart from Mr. Heperle, the firm has a foreman and an inspector.

This firm is of interest as it represents the many thousands of small manufacturing businesses. This type of operation appears to be less studied than the mid-size and larger firms. In small firms of this type, the owner often performs many of the tasks that would be handled by a specialist or even a department in the bigger firms.

People Interviewed

Only one person was interviewed in this particular situation. Mr. David E. Hepperle calls himself “Sales Manager.” However, he is the policy/decision maker, the staff person, and user all rolled into one. One of Mr. Heperle’s functions is to design the embroidery using a computer to do so. He deals with customers, suppliers, and staff. He gets the orders, determines the production processes, orders the supplies, makes sure that the work gets done correctly and is shipped on time.

Mr. Hepperle, as owner, does not report to anyone. His post highschool education was attending an embroidery “Design and Technical School”, Krefeld, Germany for two years. There he learned his trade and became a master designer.

He keeps up with the requirements of his business, as he stated,

> I have been going to Seminars for the last 15-20 years. Once a year, twice a year, basically on the trade. For everything. From selling, to merchandising, to repairing, to designing, technical tips, software tips, the whole gamut. As often as they are offered in the area. [These seminars] are offered by the embroidery group organization.

In discussing the media that might influence him in his work or introduce him to quality concepts, he said,

> I look at my quality when I am shopping in stores. And, comparison shops. Magazines don’t really offer anything. They just offer technical tips on how to…you could show the same seven guys how to. One or two of them are going to know quality. The other five aren’t going to know anything [even] if you cram it down their throats.

View of TQM

Mr. Heperle’s ideas on TQM were very interesting, being directed at his whole process. He defined TQM as,

> Total quality management to me is, basically, an overall picture. From start to finish. From how the product is handled by the salesman to sampling stages, to the production stages, and then the end results, shipping it out. You just can’t go to a house and one guy gives you a great product. You don’t know how it is being

> made, it is a scary situation. You don't know if it is a "Flash in the Pan" shot. You know, if the guy has a good representation and he shows a good sample, and he follows up with good products and he can deliver it on time, you got a good quality house.

In the embroidery industry it is usual for a customer to look at a sample design and if approved, order the production lot. Mr. Heperle's reference to a "scary situation" is that of a customer being shown a specially prepared sample that meets the needs, but the manufacturer's production process cannot deliver that quality or quantity on time.

View of Quality

Mr. Hepperle, like some other managers, does not distinguish between term "quality" when used in the sense of the characteristics or features of a product or "quality" when used to describe whether the product has the promised characteristics or not. He appears aware of this distinction when he says,

> I was broken in on quality. Quality in my eyes is not such a good thing anymore. Price dictates quality. You know, I am on a downswing of an industry. I thought that quality was the best part that separated everything. My definition today of quality would be the percentage of the order that is coming out perfect. Not, per se, the quality of the garment, the quality of the overall order that is being shipped good [sic]. That' my definition today. Basically, because that same item that I'm shipping today for $0.50, I shipped 10 years ago for $1.50. So now I have to produce three times quicker, yet be right on the money. Because if I miss, if I'm short a dozen garments, I'm out a couple of hundreds of dollars. So my

> percentage of quality today is how much of that overall order that is shipped perfect. Not piece by piece anymore.

In this statement he is swinging between design quality ("price dictates quality") and production quality ("the percentage of the order that is coming out perfect"). When asked if the words "shipped perfect" includes on time, he replied,

> On time, correct, and the quality of each garment. That is America's version of millennium quality. And, every company throughout, probably does not understand this perception yet, but they will, as you go down the road. We are all working under the gun, we are all working one third of the price, we all have to produce the same. So the [design] quality is not that important anymore, the [production] quality of the whole order is important. You deliver 98% of it damage free then build this Rolls Royce with no money.

Most of his discussion dealt with the design or feature aspect of quality. As an example, Mr. Hepperle gave this explanation when asked, "What makes a shipment 98% damage free, does this include on time?" he responded with,

> Well, I'll make a sample before I take a pattern, the same as painting a house, and I'll make this analogy clear because this way it is understandable. We make a name called, "Latzko". Within this Latzko there are seven letters, eight characters, whatever it may be. Between that, ten years I gave you 500 stitches per letter. If there eight letters, I gave you 4000 stitches. Today, due to that one quarter of the price that I am working under, I now have got to cut that down to one half. 2000 [stitches], 3000, maybe. And, my production hour versus my cost hour is even greater because my help costs more. So now I have to produce four times quicker. So

> the damage ratio when you work at such a high rate is greater. So, you now got to produce at a 99% ratio, damage free ratios. That my quality doesn't care anymore. The [design] quality I am producing now is [bad]. But, I'm producing a quality order. Not a quality garment, a quality order, I'm not damaging any goods. What it looks like, what I may think, really [doesn't matter]. It has to be passable, but you have to deliver the whole order damage free. [That means] without making any holes in any garments, without getting stains on anything.

He is regretting at not being able to give good design quality anymore because the customers want the price lowered, but is now aware that the meaning of quality today is to produce near perfect material which is delivered on time.

The Need for Quality

The statements made by Mr. Hepperle above make it clear that to stay in business he has to give the customer the design quality which they negotiate and do so on time. One could say that in his work experience, Mr. Hepperle has seen the movement towards good production quality.

The method of checking to see that the design quality is met is by inspection. Mr. Hepperle identified three stages of inspection

1. Sampling (submission of a sample product to the customer similar to a set-up check on machinery)
2. In-process checks by the foreman and/or customer audit

3. Outgoing product check by the examiner

Mr. Hepperle described this process as follows:

> We sample them, we sit down with them, we go over everything between the placements, the execution, the yarn colors. Basically the first time around you just want to see if you can perform up to their quality, up to their confidence level where you can deliver a competent product.
>
> Once this stage has set in, stage 2 arises where actual fabric does show up in your factory where you have to do production quality. Your production quality is set up on machines with mass amounts of help, maybe with day shift and night shift all together working on that. You have an examiner, the end product, you are checking everything over, because now you are going market after this.

Apparently, the customer does not rely entirely on reputation for assuring that quality conditions are met. Mr. Hepperle reported,

> [The customer has] a production or quality person, usually for the larger firms. They come around and check and make sure that you got them on the machine first of all, that you are running. Number two that you have the right colors. They just take some samples to make sure . . . Because they can't baby-sit you. But, they have to make sure that you are at least up and running, you are at least moving on it, and you are at least dealing [sic] for manufacturing a good garment.

These audits seem to occur only at the initial stage of production. Once assured, the customer appears to rely on outgoing and incoming inspections. While the work is going on, Mr. Hepperle elaborated,

> I have a foreman who floats all day long. He looks to see that the work should be as designed, all day long. That is his whole job. And I'm going to tell you why. Now, let me explain something to you

> last year, 98-99, my damage ration was under 1%. The only damage ratio we really had was due to our communication barrier. Whereas, we told [the worker] to put on pink and we spoke to him in Spanish and he put the wrong pink on [the machine]. Otherwise, the quality…*voilà* [he made a gesture meaning ok].

Type of Reports Used

Although there is a great deal of inspection and some rework, there appear to be no records kept of any mistakes nor compared to the production, either in total nor by machine or operator. Mr. Hepperle asserted, “There is no need to keep any records on the damage ratio.”

When asked if it was possible for the heads on the multi-head machines to operate differently from one another, one or more bad and the rest good, he said,

> Sometimes yes. Basically the instructor/foreman [for set-up] is instructed to watch out for quality. [The instructor teaches the workers how to operate.] He keeps on checking [the workers] as he checks the machinery and the examiner to make sure that this person is fulfilling their [sic] task.

He agreed that the operator does have influence over the quality of the work but relies entirely on the checking performed by the foreman and examiner. When asked if he had any way of telling the level of performance of the operators, he responded,

> Yes, by their production which is monitored on an hourly and daily basis. If it slips through his hands, and he is busy, the examiner will

> pick it up. The examiner is, more or less, my inside control person who examines all the goods before we pack it and send it off. She inspects everything 300%. Because, she is checking her job, the operator's job and the foreman's job.
>
> If the examiner finds a piece or two that is not correct she gives it to my hand mender in my factory also, who does small repairs.

The process seems to rely on 100% or more inspection. It is known that this method is not 100% reliable (Latzko & Saunders, 1995, p. 49) and is only partially compensated by multiple 100% inspections (Latzko, 1986, p. 65 and Appendix 2). In consequence, some small amount of defective work slips past the inspectors. Given the the damage ratio of 1% as stated by Mr. Hepperle above, and the 300% inspection used, one can calculate the failure rate to be $0.01^{1/3}$ or about 20% according to the formula in Latzko's book (1986), Appendix 2. This would indicate that a substantial amount of rework exists. The source of this rework is not clear since no data exists. It could just as easily be caused the equipment, methods or materials used, as by the operators. Most likely there is some interaction.

Determinants of Quality Standards

The customer and trade practices (which reflect the customer and process capability) determine the production quality standards. Mr.

Hepperle stated, “You are only allowed that 1%, 2% damage ratio. Beyond that, and the minimum mark-up that you are working with, you break even on every order.”

The design or subjective quality is dictated by the customer and profit margins. It is the amount of quality attainable for which the customer is willing to pay. Logically, one needs to extend that to include the producer, since producers cannot operate continually at a loss. Mr. Hepperle summed it up when he said,

> I’m going to tell you why I emphasize on my quality. Number one, you make one or two mistakes on your customer, you are out the door. Number two, if you deliver a shoddy product also, inferior, no quality control, they will hit you back with damages. That will put you out of business. In our industry, if they can get you, they’ll get you.

Quality Tools.

Apart from inspection, no other quality tools are used. Even the inspection is cursory for the operators and the foreman. Mr. Hepperle describes the inspection when he explains:

> My operators on the machine are fantastic. But they don’t have all day to turn around to take a look at something. They have a glance rate: They glance, and if it looks ok, pass it. The foreman, [uses] a glance rate again; look ok? He won’t stop any more to take a time out. We used to fine-tune that guy, today, the allowance factor is not there.

> The examiner never changed. The only records are in my overall orders, of what I'm receiving and what I'm shipping. If I'm a piece short, I get pinked for that.

Jo-Cal Embroidery Company is probably quite typical of small manufacturing firms that use tried and true artisan methods for their control of quality. One suspects that they are so busy producing items that they cannot take time out to study their processes. If the estimate of their rework cost above holds true, it might well pay them to take the time to study the process to reduce their costs.

MTA Metro-North Railroad

The Metropolitan Transit Authority is a division of the State of New York. It consists of five divisions each headed by a president:

1. NYC Transit,
2. Long Island Railroad,
3. Long Island Bus,
4. Metro-North Railroad, and
5. Bridges and Tunnels

The business unit selected for the interview was the Metro-North Railroad. This railroad carries an average weekly number of about 222,500 riders. Their 1998 operating budget was $771 million. They have 5,443 employees, six rail lines, 117 stations and about 758 miles of track. They describe themselves as follows:

Proud old names in the history of railroading New York Central and New York, New Haven & Hartford among them are the lineage of Metro-North, the second largest commuter railroad in the nation.

Metro-North's main lines the Hudson, Harlem, and New Haven run northward out of Grand Central Terminal, a Beaux-Arts Manhattan landmark, into suburban New York and Connecticut. Grand Central Terminal is now being completely restored and redeveloped as a retail hub.

West of the Hudson river, Metro-North's Port Jervis and Pascack Valley lines operate from NJ Transit's Hoboken terminal.

People Interviewed

Four people were interviewed in this case. The Metro-North Railroad has a Policy head as well as a distinctly separate Decision Maker.

The four people who were interviewed were:

1. Mr. Peter A. Cannito, President, Metro-North Railroad,
2. Howard Permut, Vice President of Planning & Development
3. Russell A. Ferretti, Assistant Director of Quality Assurance, and
4. Mr. Robert Butt, Chief Mechanical Officer.

Mr. Cannito reports to the Chairman of the MTA. He holds several degrees: BA Business Administration, Canisus College, Advanced Management Program, Harvard Business School, Executive Management

Program, from the University of Virginia's Darden School, and an Advanced Transportation Management, from Northwestern University.

He attended internal seminars on quality, such as the Tennessee Associates Quality Program, and ISO 9000 Certification Training. He also had some training in six sigma practices. The writer got the impression that Mr. Cannito was not too pleased with the latter method. He said, "When I was at Raytheon we were in the process of implementing six sigma." He did not care for the way this method became a requirement.

When asked what are his sources of information concerning quality issues, he said, "I read books. [I get some information from] other managers and associates. I'm not too sure that I see much in the newspapers as it relates to quality. I think that books and seminars are my most important source."

Mr. Permut reports to Mr. Cannito, the president. He holds two degrees: a BS in Geography from SUNY Binghampton and a MS in Transportation from Northwestern University. Additional seminars that he took were the Senior Management Program at the Kennedy School, Harvard University and the Executive Management Courses at Northwestern University.

He looks at all media. He said, "In a public agency like Metro North,

the media is a major influence of how things are done. I read New York Newspapers, listen to the Radio and TV. Not just New York City. We have papers out in the suburbs, Connecticut, wherever Metro North goes."

Mr. Butt reports to the vice president, operations. He holds a BA in Management from Lehigh University. He attended seminars related to quality when he worked with Mr. Ferretti, but he does not remember the details at this time. As he stated, "I haven't had a heavy background in quality."

As far as media is concerned, he said, "Most of the media [I read] is Industry related: *Railway Age*, *Progressive Railroading*, I also read a magazine called *Maintenance Technology*."

Mr. Ferretti reports the Director of Industrial Engineering & Quality Assurance. He holds a B.S. in Civil Engineering from the University of Rhode Island. He is a professional engineer in New York and New Jersey. He is also an ASQ Certified Quality Auditor and an ASQ Certified Quality Manager.

He has taken a number of quality related seminars such as Learning Tree International seminar in Software Quality Assurance, ASQ's Seminar on Quality Auditing, and ASQ's Basic SPC Seminar. In addition, he has taken courses and been an instructor in Quality Control at

the Annual Railroad Quality Conference for the last 5 years.

He gets information about quality from the following media: *Quality Progress*, ASQ Headquarter's publications. As far as trade journals and organizations are concerned, he elaborated,

> *Progressive Railroading* is a Railroad Journal but it doesn't really touch on Quality. The Association of American Rail Roads has a quality standard. It is a complement to the ISO [9000 standard]. There is also the National Association of Purchasing Managers which has a Rail Road Division and a Quality Committee, of which I also have been a member for the last five years and of which I am also the chair.

View of TQM

The various definitions of Total Quality Management (TQM) reflected a greater need to be concerned with having quality rather than defining something as elusive as TQM. Mr. Cannito expressed this theory best when he explained,

> I'm not sure that there is a definition of Total Quality Management. It changes. A lot of it changes at where you are at, particularly within your organization, at the moment. Quality is not something that interests [me] like it does you from a professional basis. It is more of one of results. Based on our performance, that definition changes. [TQM] implies that there is a technique and also implies that there is a specific focus on it, rather than being something that just inherently is involved in everything that you are doing. I don't think that anybody makes a decision to do something with the intent of it not being a quality program. It doesn't make sense to say that I am going sacrifice 50% of my quality so that this is not total quality management, this is going to be 50% quality

management and 50% what?

During the interview, the writer said, “In my book I said is that it really isn’t the quality that is a method, Quality is the result of a method and the method is good management.” Mr. Cannito responded:

> I agree with that. And the method is whatever method work for you. And that was quite frankly one of my real problems with Tennessee Associates. We had a real problem with the method because they have a very defined method. And frankly, you get to a point where the method becomes more of a burden, too much of a burden for what you are attempting to do. Then, all of a sudden, you get a negative reaction to it.

That statement could explain the reason for Mr. Cannito’s negative view of the “six sigma” processes. Apparently, in Mr. Cannito’s perspective the method takes more effort to implement than it saves the organization.

Mr. Permut also responded with, “I don’t know that I have a definition for TQM.” He then went on to speak about the purpose of quality in an organization by saying,

> The fundamental goal is to provide a high quality experience to people. The hope is that, and it has been our experience that, by doing that, you not only keep your existing folks happy but you get new ones. You build your rider-ship, you build your market. That’s been the overall approach.

Mr. Butt looked at TQM from a more specific perspective yet also as an means to an end. He stated, “My definition of TQM is boiled down

to constantly asking yourself the question, is there a better way to succeed in reaching your goals."

Mr. Ferretti considered TQM to be "Soft Quality Assurance". He expanded idea as,

> I admit that I don't know much about TQM. The first thing that popped into my mind was soft quality assurance or soft ISO 9000. Softer methods and a trust me approach. I think that I would also say SPC performed by workers to assess their performance.

All four of the executives seem to have a common view that they need to accomplish an objective, good quality service, and that, if anything, TQM can help them achieve this objective. However, since they already have methods such as good management practices, or ISO 9000 systems, TQM unnecessary. The writer believes that this illustrates the problem with the terminology "TQM" as mentioned in Chapter 2.

View of Quality

Mr. Cannito's view of quality is people oriented. He said,

> My view of quality is that it has to do with how well people are doing their jobs, regardless of what it is. There are certain things that are objective and can be very thoroughly measured. There are other things that are subjective and that are not so easy to measure. From our perspective, being a service company, we are as good as the perception of our ability to interact with our customers. And how well we perform because our customer is part of the process can be easy to measure or can be more difficult to measure. A good example is the air-conditioning. The air-conditioning quantitatively

> we can measure. Subjectively people may have different comfort levels. But, I can measure it to the basis of the temperature that I'm able to hold.

Another major area of quality, in Mr. Cannito's view, is communication. In communication theory such as described by Lau and Shani (1992, see chapter 11) communications is likened to transmission via radio, There is a sender and receiver. Problems in communication can occur just as static can interfere with radio transmission. Mr. Cannito describes this by contending,

> One of the areas that is a major service issue in this company, and any company like this, would be customer communication. Communication is something very difficult to measure. Particularly, for our communication to work, the action has to be on the part of two people: My failure to communicate may be one problem, but, your failure to listen to my communication is another problem. We try to do a very good job of sending the message out, and we are constantly trying to improve on the methods of sending the message out. But, no matter how hard I work on sending the message out, if the receiver is not prepared to listen to the message, or if he or she listens to the message, how they translate the message once they receive it is something I can't control. So when I'm measuring the quality of our communications, it is a lot more difficult than when I'm trying to measure the temperature in a car. Or on the mechanical side, measuring the mean distance to failure (MDTF). That is very easy.

Another area of quality outlined by Mr. Cannito is that of policy. In a way this area reflects Dr. Deming's frequent statement that "quality is made in the Boardroom" (Latzko et al., 1995, p. 27). Mr. Cannito averred,

> The other thing we work on is policy issues. You know, a service company has policies. Part of the customer service we provide is how flexible are our policies, how clearly they are communicated, and whether or not they are bureaucratic or they are user friendly.

Implied in these statements is the recognition that the customer is important and that the organization's quality efforts need to be directed to meeting the customer's needs.

Mr. Permut also defined quality as meeting the customer's needs. Speaking about the results of customer quarterly survey scores he stated, "By and large, on a scale of 1 to 10 we always get an 8. Plus or minus a couple of tenths. What that is most closely related to is on time performance, all the quality stuff." When asked to define the "quality stuff", he defined by saying,

> Well, the air-conditioning working, the cleanliness of the cars, the seating, having enough seats for the people, you have announcements, you have outlying station cleanliness, the route condition on station, the condition of Grand Central, the train schedules, the view of us using Internet [web site], how clean our train toilets are. There are a significant number of quality areas which we ask about. We manage off of these surveys as well as off our internal production data.

Mr. Butt looked at quality from the maintenance view. As he stated,

> In my particular business, which is equipment maintenance and servicing, it's the fact that the piece of equipment that we provide to the customer is, first of all, safe, it is reliable, and it provides the customer amenities that the customer expects.

In discussing safety, he expressed this as “not presenting the hazard either to the customers or the employees who are operating the equipment, or to the public who are along the right-of-way.” For reliability, he defined, “that it will achieve its intended mission, i.e., get the customers from their origin to their destination, on the schedule that has been designed.” He further defined customer amenities as, “[being] warm or cool to the appropriate season, that it is clean, that the seats are comfortable, and that the lavatory facilities are clean and useable.”

Mr. Ferretti defined quality as “conformance to established requirements.” Among the requirements are the on-time performance and Mean Distance Between Failure (MDBF). Reliability engineers will recognize the latter requirement as equivalent to Mean Time Between Failure (MTBF). One might anticipate that a new system (or newly reconditioned system) failure occurs at an exponential rate as weak parts of the system fail early on and are replaced with new parts. Once the weak parts are gone, the system has a small, but steady failure rate until wear out sets in.

The Need for Quality

Mr. Cannito viewed quality as a means to achieve the corporate

financial objectives. As he explained it,

> We are not looking at an operating profit or return on invested capital or anything like that as a measurement because we are not [a] for profit [organization]. But we are looking at the revenue to cost ratios, particularly as it relates to the subsidy. We continually are trying to reduce dependancy on the operating subsidy by increasing our revenue/cost ratio. You can do that in two ways, one is by growing revenue, the other is by reducing costs.You can grow revenue in two ways, one is in increasing fares, the other is increasing rider-ship. From our perspective, we run a fairly fixed schedule. So we have a certain capacity.
>
> Now if we have a train out there that is, say, ten cars and we have1300 seats, if I run the 1300 seats it costs me the same whether 25% of the seats are filled or 50% of the seats are filled or 100% of the seats are filled. There is an incremental cost, there is a variable factor there. Particularly with regard to ticket collection, because we still do that manually. But, as far as propulsion costs are concerned, the cost with regard to the operation, maintenance costs with regard to the vehicle, maintenance cost with regard to the infrastructure, that is fixed regardless how many people I have on the train. So if I'm running, say, on the average of 75% capacity that means that I have 25% growth factor for a very small incremental cost that is associated with the growth.
>
> Therefore, if I can increase my rider-ship, not changing my costs, dramatically, while I am increasing my revenue significantly. And that has an effect on the operating subsidy. Likewise, as you are improving the quality of product . . . I believe that there is a payback to quality in the sense of cost. For example, the better I perform my maintenance on a vehicle, the less it is going to cost me overall with regard to the maintenance of the vehicle because I will have less breakdown. If I am spending my dollars properly in a preventative sense, I am going to have less cost in a reactionary sense. So one of the things we are pushing here is preventative maintenance and measuring MDBF between preventative maintenance cycles. Because my preventative maintenance is not fixed it is somewhat variable, but it is controlled. Whereas, my

> reactionary maintenance is not . . . I have no control over when it happens or what it is.

Mr. Permut also looked to quality to build rider-ship and so increase income and very little expense. He uses the quarterly surveys to determine the quality performance levels. It was not clear how he tied these performance levels to rider-ship. The goal of the organization for quality is to completely satisfy their customers.

Mr. Butt also tied in quality to rider-ship. He said, “That [quality] keeps our current customer base and provides a level of service that will attract additional customers.” When asked if there is any quantification of that statement, he replied,

> Between quality and rider-ship? I don’t know that we have done any specific studies. But I know that in our striving for those quality pieces that our rider-ship has grown steadily for several years. Has generally not fallen off as a result of any increase in fare which sometimes is the case as fares increase. We certainly measure things such as rider-ship and ticket sales. We measure some of those quality issues that I mentioned through Mean Distance Between Failure (MDBF) measures to measure reliability. We have safety inspections from the Federal Railroad Administration that we constantly use as a benchmark. We have customer surveys, which is input from the customer, as well as our own service quality inspectors who ride the trains and report back on various, mostly customer amenity issues. Train cleanliness, restroom cleanliness, train lighting, condition of train seats, etc.

The executives of this company have an objective to reduce subsidies by increasing rider-ship. From surveys and other measures,

they feel that there is a close correlation between quality and rider-ship. It is their consensus that continual improvement in quality of their operations, they will accomplish their financial goals.

Type of Reports Used

Mr. Cannito said, “What I generally see is a morning report is a safety failure.” When asked how he uses this information, he replied,

> I don’t use that information, that is done at a lower level. Also, it is history. And frankly, at my perspective you can’t address [the problems reported] individually. There are statistics that we maintain or reports generated that show you trends and measure performance. And those are what I am more interested in. On time performance is an indicator, for example. You measure on time performance by areas of responsibility. Mean distance to failure is a tool. Repeat failure is a tool. We keep a 90 day report. Failures during a 90 day period, repeat particularly. . . so, there are reports that are generated that basically give you what I’m more interested in, not the incidence itself.

Mr. Permut gets a monthly report with all the measures such as on-time performance and MDBF plotted out over time. He did not have such a report available. It sounded much like a run chart. He stated that the use of the report is to improve operations. In his words, “The challenge to Metro-North is the use of the data by the right people and putting into place the necessary program to change things. Our measurements are far ahead of production.”

Mr. Butt said, “We also measure month-to-date and the previous month and year-to-date numbers.” He showed the writer the reports that he uses. These reports were all numeric, a large quantity of data. Mr. Butt explained, “They [the reports] were all designed at various stages in Metro-North. Metro-North started in January 1983.”

Mr. Ferretti explained the reports that are issued by his area are essentially audit reports. He said,

> For the most part, we are the report preparers, in my group. We do audits of other work groups, contractors, consultants, suppliers and in some cases our own Metro-North staff. We issue reports on what we find to various higher level managers.

He went on to describe the nature of the reports his department issues. He stated,

> They are a standard Format audit report. It basically has a cover letter, its report describing how the audit was performed, the basis for the audit, the standard, the objective of the audit, participants in the audit, documents which were reviewed, description of how the audit took place, findings, overall conclusions, any observations, non-conformance are called out, and a sheet which is prepared, which goes to the audited group for any non-conformance problems requesting corrective action.

In discussing how contractors can be compared using these audit reports, he explained,

> We do have a report which rates our contractors in terms of percentage. That gives a little better feel for whether a contractor’s quality program is mostly right or mostly wrong. The percentage is

> that of meeting 135 different aspects which are measured during the audit. We have a standard check list of those 135 questions which are used from audit to audit.

In all, the reports used to check quality at Metro-North are tables of numbers which are the results of measurements such as on-time performance, MDBF, and other measurable criteria. In addition, quarterly consumer surveys are conducted to check the relevance of the internal measures. Finally, periodic management audits are performed to see that procedures are followed, and if not, that corrective action ensues. Almost all of these reports are point in time often compared to a similar point in the past. The exception appears to be a line chart showing train and station inspection findings over time.

Determinants of Quality Standards

The quality standards are determined by regulatory requirements supplemented by the objective to increase rider-ship. While the regulatory standards are a minimum, the goal to increase the rider-ship requires continual improvement of the system. As Mr. Permut explained,

> What we have done is set a stretch goal to be a 10. We have a program called Vision 2003 which is twenty years of Metro North's existence to provide highest quality customer service. We want to be a 10 in 2003. The goal was set as a stretch goal, it says that you want to be perfect.

The mechanism for determining what the customer's want is dependent on the survey questions. In a way, the customers are the determinants for the quality standards.

One can visualize that design standards might present a difficulty in achieving the goal set for the year 2003. For instance, in the case of temperature (whether from air-conditioning or heat), customers will have varying opinions of the temperature at which they like to travel by train. Setting any particular temperature will please some and displease others. A customer survey using the Loss Function method of Dr. Taguchi will indicate the temperature displeases the minimum number of passengers. Such techniques appear not to have been used in the past. Nor has the method of quadrant analysis (such as Customer Window K) been used to determine the importance of the various parameters of customer satisfaction.

Quality Tools

The most frequently mentioned quality tool was management. While modern methods of management achieve quality output, they do employ some sophisticated tools. The writer sensed that there was a distrust of these tools. Mr. Cannito, for instance stated,

> Frankly, I'm not that familiar with quality tools. I'm familiar with some of the tools but I don't remember the names that are associated with the [various programs].

He then went on to describe a method of problem solving using one of the quality tools, the Pareto Analysis,

> One thing that I do think is important, that always stick in the back of my head, had to do, basically, with the Pareto method of looking at quality. If you are going to focus on improving the quality of whatever it is then you are looking to improve, you need to have a systematic approach to how you are going to attack it. And before you can even look at what you are going to fix, you better know what's causing the failure. So you need to go and study it, determine what is the cause and then, systematically you attack it based on attacking the issues that caused the highest rate of failure. It has to be a continuous process. Once you have done that, you need to continue measuring it, one to see the success of it, and two if you are doing it properly your chart's going to change. And then you go to the next one.

In effect, he is proposing a modified version of Juran's Breakthrough Technique. This is a tool that he trusts as evidenced by his next statement,

> That looks very logical to me, makes absolute sense, and if I can instill that in this organization and have a continuous review of that, I don't need any other quality tools.

He goes on to explain why he does not like other tools when he says,

> Where I am probably critical of the quality processes that are being sold now-a-days is that all of them are nothing more than a variation of [Juran's Managerial breakthrough]. And the processes

> are so structured that you absolutely have to follow it. That when you get into the training issue.
>
> That is where, from my perspective, the managers and supervisors become frustrated. Because now, the task of measuring and implementing quality becomes harder than the task that you ultimately perform anyway. I like to keep things simple. If I had difficulty doing that, then I will have supervisors and workers that are going to have as much difficulty, if not more difficulty. So therefore, I just rather keep it simple.
>
> He then states his philosophy regarding tools as,
>
> My feeling is that if all of us are just continually looking at what our responsibility is, measuring it, determining what the cause of the failure is, and focuses on that, they are going to continuously improve. Now, maybe they are not going to make [as much progress then] if there was a more structured process and they are disciplined enough to follow that. Maybe they are not going to make some greater improvements. But I do not know if that is the case. That is a big maybe. From my perspective it is a risk. I rather keep it simple for them so that they don't feel negatively about it and continue to do it. And have something that they understand. In that way, at least I know that am getting improvement.
>
> He then goes on to talk about the six sigma process and why he

felt that it was not suitable for Metro-North. He said,

> Part of the six sigma and the statistical analysis that you have to do to do all these measurements. I guess if you are at GE and you get all the engineers on your staff that have that capability, fine. But frankly, we are a railroad and we don't have that same level of talent in the sense that they can perform the statistical analysis. I am sure as hell not going to put a statistician on the staff of every person out there.
>
> This statement is very interesting and could explain why the writer

was told at the Annual Quality Congress that the “Six Sigma Academy” used by the ASQ now recommends not to use statistics or statisticians in their work (personal communication, 8 May 2000). It also indicates that the process may have been presented poorly, since the thrust of six sigma, as used today, is not statistical but a version of Juran’s Breakthrough Technique under another name.

Mr. Permut also distrusts many of the tools of quality extolled in the quality media. The constant change of name for what is basically the same problem solving method makes him suspicious of all tools. As he stated,

> By and large, my view is that a lot of quality stuff is what I call it when someone is faddish. Someone comes up with a term and then that is the term for three years. Six Sigma is the latest. TQM was last. By and large, we had never done that. We had a pretty steady focus on customers and what I would consider as a logical program about quality. Maybe we have missed something.

Mr. Butt did not know of any quality tools used but expressed an interest in control charts when this process was explained to him. Mr. Ferretti thought of quality tools as the audit. He is, of course, aware of other tools and indicated that he thought that these may have an application in mechanical areas such as that headed by Mr. Butt. As he stated, “We have planned to do some statistical process control in our

mechanical department."

Overlook Hospital - Emergency Department

Overlook Hospital is part of the Atlantic Health System. Accredited by the Joint Commission on Accreditation of Health Care Organizations, it is affiliated with the Columbia University College of Physicians and Surgeons. The hospital describes itself on its web site as follows:

> Overlook is an Atlantic Health System 490-bed major teaching hospital in Summit, New Jersey. Home to New Jersey's first stereotactic radio surgery program, Overlook Hospital's specialty services include a blood disorder center, the Valerie Center (a pediatric cancer program), a neuroscience center, a cardiac catheterization laboratory, a comprehensive rehabilitation medicine program and a Chest Pain Center in the Emergency Room. The hospital is also a designated Community Perinatal Center-Intensive Level, providing critical care services to high-risk newborns.

The business unit selected for the case is the Emergency Department of the hospital.

People Interviewed

Three people interviewed in this area were suggested by Dr. Espinosa after discussing the three or four positions that the writer was trying to interview for each case. Dr. Espinosa suggested that the policy and decision maker be Nurse Kosnik, the user be Nurse Dietterich and

that he be considered the support group member. The respondents are,

1. Linda Kosnik, RN MSN, CS, CEN, Chief Nursing Officer, Overlook Hospital (Atlantic Health System) reporting to the Hospital Administrator,
2. Linda Dietterich, RN, MS, CEN, CNA, Manager, Emergency/Critical Care Services reporting to Linda Kosnik, Chief Nursing Officer, Overlook Hospital, and
3. James A. Espinosa, MD, Medical Director, Emergency Department, Overlook Hospital, Summit, NJ

Ms. Kosnik holds a B.S. Nursing from Columbia University, a M.S. Nursing from Seton Hall and is a Certified Nurse Practioner. Her background in quality comes from some internal training. She attended AHI presentations, Dr. Espinosa's internal training and ODI training where she learned the FADE concept. FADE stand for

- Focus
- Analyze
- Develop
- Execute

Ms. Kosnik says that she reads everything. She finds out what's being done and tries to avoid re-inventing the wheel.

Linda Dietterich is the manager of the Emergency Department. She

succeeded Ms. Kosnik on her promotion. She hold a RN Diploma from St. Anthony School of Nursing, Rockville, IL, a B.H. (Bachelor in Healthcare) - St. Joseph's College, Wyndham, ME, a M.S. in Health Education from East Stratford, PA and is Certified in Emergency Nursing, and Certified in Nursing Administration.

She has attended a number of seminars that, as she says, "People come in and do it, teach us right there." Many of the seminars are not quality specific. As she said,

> I don't think that they are related to my work in quality are basically classes in specifically in emergency nursing. Any courses that I can get my hands on. A pediatric course, I just took a pediatric course for certification. "Advanced Cardiac Life Support" are courses that we take, we have to take every two years. Nursing Administration, I am always going to seminars. But, most of that is geared around the administrative duties of an administration.
>
> The tools such as Root Cause Analysis, Control Charts, etc, that all came out of our CQI [Continual Quality Improvement] process for improvement management seminar that we all went to. It was two days worth of going through the process. Actually, Atlantic Health put that on. And that was excellent. The ten step process, I know it very well. The P-D-S-A is another one.

She read extensively, both trade journals and general magazines. She also makes use of Video tapes, both internally created as well as externally produced.

Dr. Espinosa is unique. He described his educational background

as attending Hahnemann University, a school of health professions operated by Drexel University in Philadelphia, PA. Dr. Espinosa said,

> I was admitted from Highschool and got my BS and MD. I have the title FAAFP, (Fellow of the American Academy of Family Practice) and FACEP(Fellow of the American College of Emergency Physicians). I am Board certified in Emergency Medicine and in Family Practice.

Dr. Espinosa is very knowledgeable in the field of quality. He explained,

> Over the years I have attended all sorts of courses related to quality. And taught these courses. Some under ASQ and some under National Association of Health Care Quality, Some with the Institute for Health Care Improvement. I took all sorts of courses, statistical courses, process control courses, classic process control (SPC).
>
> I founded the Section on Quality Improvement of the American College of Emergency Physicians in 1993 and was their chair for several iterations. I still edit their newsletter.

Dr. Espinosa learned much about quality by his reading. About periodicals and newspapers he said,

> I read the newspaper and will sometimes read the *Wall Street Journal*, not religiously but on occasion. Then I read a whole variety and in a very disciplined way of medical literature. Out of that of many things in there I conspicuously look for items related to quality. I specifically get some journals related to quality. I belong to the American Statistical Association (ASA) and I get their journal [AMSTAT News]. I belong to the American Society for Quality (ASQ) and I get their journal. I also get *Quality Progress*, *Technometrics*, and the *Journal of Quality Technology*.

In addition he has a large library of books on statistics and quality. He explained,

> I probably invested $3,000 worth of books. My wife would often complain over the years about the incredible investment in books. If there is one place that I have probably learned the most, I think that it is out of books. I have just about what has been written, other than obscure stuff, about the whole literature about Statistical Process Control (SPC), maybe about 30 texts on that, probably three times that many on statistics, epidemiology, and then, anything that I could ever find on tools, all of [Dr.] Brian Joiner's stuff, all of Deming's material, Juran, Crosby, several books. I have all of Juran's books. In fact, I have, and am very proud to have it, autographed copies of Juran's books. From Joseph Juran himself, who took a shine as to the things that I was saying about him in Health Care. I have advocated early, in the 1990's, that the Juran model for service was probably the most approachable for physicians, rather than Deming. Although, I incorporated Deming. That is how I structured the section on quality improvement in a lot of the projects that I did. Especially, [the work I did with] around customer service and patients satisfaction had to do with the Juran Trilogy, and I taught the Juran Trilogy inside the house of medicine.

Dr. Espinosa is one of a few physicians that the writer met who has an excellent grasp of the concept of process and how to work with it. As a result, the writer asked him what caused him to be interested in this process. His response was very instructive and important to the conclusions. Therefore, his response is reproduced here even though it is lengthy. Dr. Esponisa said,

> I think that I was raised this way. I really think that it is instinctive for me. I don't know how to explain that. It is very intuitive for me. I was sort of raised by Jesuit wolves. So I have a grounding [in

philosophy], as we talked about it, plus I have a grounding in anthropology, sociology, group process theory, all kinds of things. Since I did Med School early, and I was very young, I was able to study extra things for about two years inside that structure.

One of the turning points for me formally was that I was the youngest Medical Director ever to take over an ER in the United States. And I took over an Urban ER, which is a knife and gun club in Camden, NJ. One of the immediate problems that confronted me was that five nurses had been assaulted, physically struck, in the last six months before I had arrived. There were two broken jaws and several other problems due to violence.

The Director of Security, was a very young guy himself, His mother was involved in the Quality Circle movement. We were talking about how we could fix this thing. I heard something from reading about these approaches of defined process steps, and I kept referring to the fact that the system was designed to allow that to happen. That there were these inputs to the system that were danger, that there was no way to resist [this danger]. It struck me as a species of path-physiology, it was very much medical to me. We met with them [the security director and his mother].

Eventually, I tracked down a guy who was with GE, who was a consultant actually, who called me in and told me that he really wasn't supposed to do this, but he walked me through the GE manual for quality. He walked me through it in about one hour and a half. He showed me every page. I just sat there and watched him flip the pages. This was, of course, heavily copyrighted. I said, "Thank you very much." That will do. I figured out exactly from that one and one half hour meeting with him [what to do]. What we did, we re-engineered the way we processed that and we published the first quality improvement abstract in emergency medicine about this problem. We reduced violence. We measured incidence of violence, near misses, we measured the amount of property damage, and then re-engineered it. [Thereafter] it was very stable.

The second lesson I learned is that I went up to Overlook [Hospital] and within six months of my leaving, that whole thing had gone

> back [to its original state] again. Administration had taken the structure and cost cutting had just undone it. In other words, they got rid of the camera, they got rid of the metal detector, they got rid of the dog, they got rid of the extra guard, and they were back to trouble again.
>
> It is interesting to read Deming, Juran, and Crosby, I took to Deming because Deming was sort of then counseling me about the role of management by reading and by precept. I got to hear him speak a couple of times in Philadelphia. It struck me then . . . although this stuff can be done on the ground and bubbled up, it cannot sustain itself unless management gets it. And that was the great tragedy, the fact that management did have the ability to drive this and then even dismembered anything I built.
>
> That was the way in. I got started with problems. What I've learned has all been about problems, fixing cycle time, fixing thermalitics[sic], fixing this, fixing that. So I have an education that is integrally linked with something I had to fix. I got good enough at it. Other people called to get problems fixed. I started to teach the approaches to this but was met with ridicule by the house of medicine. Before the health care revolution, doctors didn't care at all to hear about this kind of stuff. They met this stuff with disdain.

Doctor Espinosa's reading and association with Deming Masters, such as Dr. Tom Nolan, gave him an opportunity to learn the quality control systems and processes. He has used this knowledge to improve the operation of all areas with which he comes into contact.

View of TQM

The three people who were interviewed had a variety of views ranging from looking at is as a method to refusing to define it at all.

Nurse Kosnik defined TQM as a method by saying, “Continual Quality Improvement. The way you manage every day to make every system the best that it can be.” Nurse Dietterich also viewed as a method of team work, an old definition at best. She stated,

> In medicine and in the health care environment, total quality means that it is a total team, evolving, in working collaboratively on the quality [aspect] of that problem. So it is a team effect, it is cohesiveness, collaboration. You need inter-departmental participation in order for it to be quality. We don’t use the terminology anymore.

Dr. Espinosa took a strong opposition to the use of the term TQM. When asked to define this term, he said,

> I’d really fight to even define it. I’d rather not define it. I have been there, done that about 30 times. I heard 100 other people do it and it just drives me nuts. I have heard people turn it into a verb and I realized that we have truly gone too far.

This reaction was very interesting since it shows that Dr. Espinosa recognizes that the continual improvement of processes is not a bag of tricks but good management methods and tools applied to some underlying process problem that causes quality of the output to be poor.

View of Quality

All three respondents equated quality with its design aspect. They look upon Continual Improvement and the methods needed to attain this

as the production quality.

Nurse Kosnik said, “Quality is every day activities [done well].” She indicated that Continual Quality Improvement (CQI) requires the need to get used to change. She said,

> What you know you are comfortable with, why change? It is all in the attitude of the person in charge, It is the difference between comfort in the quality of life and what is good from the physicians view but not necessarily from the patients point of view.

She then went on to say, “Quality is the achievement of optimal outcomes.”

Nurse Dieterrich gave this definition: “Quality means the best outcome for the person taken care of. My patient better receive the best from me, the best care, the best of everything.” She then went on to define what is the “best.” She stated,

> Quality is not just hands-on care. It is also what you say, how you present, the total picture. If you present yourself positively, caring, and compassionately, your patient and your family are going to see that and know that they are in good hands.

She stated the reason that this does not always occur as,

> A lot of times what happens is that people get caught up in what they are doing and they forget the human side of it they honestly forget that that person is a person. It may be a critical setting, it may be a person who cannot communicate at the time, but they are still human beings and they deserve that respect and that care.

Dr. Espinosa was aware that the term quality is a transcendental

term, a term that can only be defined by referring to itself in the definition. Hence he said,

> I actually think that if I got pinned to the wall on quality, I would probably fall back more towards brother Juran than anybody else. I think that at the end of the day, I am closer to the philosophical notion of its fitness for use.
>
> It has a conformance to standards element, but those elements should be fit to use. Therefore, I keep coming back to Juran as a harbor in this area on quality. I respect other people's perspective on this.

Dr. Espinosa's definition is an operational definition of quality. The specific test is whether the element considered is fit for use. The criterion is the conformance to standards. The decision is the outcome of the test.

The Need for Quality

Nurse Kosnik stated that the time spent in Emergency Department is directly related to customer satisfaction. Customer satisfaction is related to profits.

Nurse Dietterich made the same connection. In response to a question, "what does quality do for an organization?" she responded,

> Do you know how it translates? Because if you please one person, that one person will go out and tell many, many more how well they were cared for, that their outcome was a positive outcome, and that will bring more business. More customers come to us then and that is good. It is bad when you have a patient who goes out and gives us bad press. That bad press can kill you. They are going to tell

> people, “Oh, don’t go there, that is the worst care I ever received, I wouldn’t take my dog there.” I heard people say things like that. That sends a message to the community. I don’t want that kind of message going out. I want the message going out, “I went to Overlook Hospital,” for instance,”within that Emergency Room or that Hospital I received excellent care. I will recommend that Hospital to any body.”

When asked, “is there any way of translating this referral of patients to income?”, she responded,

> It attracts other physicians, other nurses, other health care providers to come to that hospital. And when they come, especially when those physicians come, let’s say the neurol-science team for instance, That brings on new physicians and that brings on more revenue, more patients, more everything. The Pediatric emergency Department that is coming . . . our pediatric level already is on the incline, it is skyrocketing, we can’t take care of this population in our existing ED. So we are going to put on, in addition, a pediatric ED. When that happens we are going to bring on pediatric physicians, we are going to bring on patients. It is a self generating improvement.
>
> By decreasing the length of the stay, we can give more care with the same staff. Our cycle time [reductions] brought more people here. People would come here because they knew that they could get into fast track, have their minor injuries cared for within 60 minutes, let’s just say, and are out of here. That speaks for itself. In some ER’s you would go to, you would sit there for four hours. We didn’t increase staffing. We looked at how we staffed and became more productive with what we had.

Dr. Espinosa also indicated that the reduction in cycle time, i.e. the length of stay in the Emergency Department, has allowed more patients to get better care with the same staff as before. In other aspects, such as MI

(Myocardial Infarction or damage to the heart muscle) the CQI methods have reduced the cycle time to such a small amount that the National Institute of Health uses this Emergency Department as an example of what can be done in ER. It is known that the faster the treatment, the greater the chance of saving the patient's life.

Type of Reports Used

The ED uses several types of reports. Dr. Espinosa introduced the concept of real time reporting using computers. These are a series of run charts. As Dr. Espinosa stated,

> Having defined these things, we create these control standards and run that machine and keep that function going and see whether we are there or not there. The only contribution we made to the field of medicine, that I think is rather remarkable, is that notion of real time data. Right now, as we are sitting here 9:15 a.m. if you touch that screen, every worker in ED can know what happened on six critical processes at 15 minute cuts for the last 3 - 4 hours.
>
> They are, by protocol, empowered to make changes in real time, without calling me or an administrator, to balance that structure to bring it back to the goals. And the goal lines are set in on yellow on the machine. These are run charts.

Nurse Kosnik also referred to the run charts. Run charts are used she indicated that Control Charts are "poorly understood" by the nursing staff. She said, " Their use [Control Charts] depends on the audience with which you are communicating. The reports are made audience specific."

Dr. Espinosa had a somewhat different reason. He said,

> The other thing is that in medical quality the ability to control the upper limits is limited unless one mitigates early. If you do control charts you will have very wide upper and lower control lines. It looks acceptable statistically, but by no means is it a goal.

The writer asked Dr. Espinosa, “is there any danger of tampering when using run charts and goals?” Dr. Espinosa replied,

> Well, I suppose there might be, but the system is so complex as it is, that it is hard to over-control it. You add to it, you moderately push it down to the goal, but it tends not to see over-control kinds of variables. It is not that kind of path of physiology, it is a collection of these lines of process. It is a matter, if anything, of biasing the system towards the specs that we know are connected to patient satisfaction. Actually it is a long queuing theory line with real time adaptation of capacity to demand.

There are some other recent changes made in the reporting system for ED. Dr. Espinosa explained:

> We also re-engineered the way we did that just in the last two months based on some notions we had heard from [Dr. Paul] Batalden, he is a friend of [Dr.] Berwick’s. [Writer’s note: Both Dr. Batalden and Dr. Berwick are MD’s who have been in the forefront of health care quality.]
>
> Paul had done some work with the National Academy of Sciences. The NAS contacted me and asked if we could be part of a group that would be interviewed around the issue of so-called micro-systems. Paul has this notion, another one of his crazy notions that is probably true, that certain systems in health care are actually micro-systems. He thought that ED might be one of them and he was looking for high functioning ones. We began to, through the fact that we were in that process and I saw some of Paul’s lectures at the Forum recently, we began to think of ourselves as micro-

systems.

So if we think of ourselves as a micro-system I decided that we were going to change our reporting structure. We literally, now meet as a micro-system and we report out now as a micro-system. It used to be that nursing had to report, medicine had to report, etc. I broke that up. It took me years to change that. And then I got it so that it was the ED as a department that reports. But, now I have this reporting structure. So, basically, what is also in the data base, is that we took the cell charts and we pulled them into a word document so that the reader can simply look down the document, sees these things and doesn't have to go looking for charts. They are right there. It is not like the chart is an appendix of the report, it is the report.

Now the problem becomes what do we see and what hypothesis do we have about what's going on.

The other thing is that [the report] shifted over to being problem solving. In other words, I'm looking for problems. I'm reporting out the things that we have accomplished that are in maintenance. It is critical to me, and I will go toe to toe with these hospital administrators, the moment they see that something looks stable to them, they, in their wisdom say, stop reporting on it. We want to maintain them. In addition as we mesh with other areas, I may be, inadvertently, inflicting change on one of my previously stable systems. I would never know that [without maintaining the reports]. Plus it is so much less energy to maintain, than is to switch, so why would you not want to keep it in the maintenance world.

It is collaborative, we did it with this team. All the words on it [the report] exactly how I would have edited it myself, but, you know what, I wanted is for everybody to have a piece of it.

Other reports that are used are story boards for the staff and visitors. Those for visitors are posted in the entrance hall of the hospital, next to the reception desk. The staff story boards are put into the break

room. They are designed to be absorbed in the time it takes to drink a cup of coffee. Their purpose is to inform and to inspire the staff.

Determinants of Quality Standards

The quality standards are based on the customers via surveys. Regulatory agencies such as the Joint Commission on Accreditation of Health Care Organizations (JCAHC) have standards that must be met to achieve accreditation.

Dr. Espinosa gave a description of how levels of quality are determined as follows:

> It has to be context specific and measurable. It would depend on which of the outcomes we look at. That I have a way of thinking about it. The ultimate outcomes in medicine fall into one of four boxes, which are
>
> 1. Medical, which are short term physiologic parameters (blood pressure, heart rate, airway management, long term physiology, intermediate physiology, that they are alive one day, two days, n-days–and longer term physiology–30 days, 60 days, a year).
>
> 2. Patient satisfaction, the experience of the patient going through this process, which can have any of fundamental definitions. These usually have to do with caring and comfort, perception of privacy, technical skill of the people around. It is perceptual, for sure.
>
> 3. Cost of the event, which is a legitimate outcome of care, measured usually in dollar signs but in any number of parameters (such as Deaths or Survival).

4. Quality of live needs to be divided into two subsections

   A. For the patient (will the operation be a success, will the patient ever walk again) and also

   B. For the provider because the health care provider inside this machine called, a hospital, is exposed to the same sorts of risks, the same sorts of danger (e.g. noise, circadian rhythm, light, safety issues, sharp items contamination) as our patients. The provider is exposed to an extraordinary psychological damage from the experience.

The determination of quality levels seems to be a combination of what the patients and their families want, what the accreditation organizations want and what the resources, medical, financial, etc. of the hospital can give.

Quality Tools

All of the quality tools are known to the respondents. Nurse Dietterrich said,

> Jim chooses the tools we use. He knows the best way to show what we can get out of it, what we can achieve from it. Even doing some of our own numbers, our own statistics, we changed how we presented it. It was incredible, it made you look at it [the data] in a whole different way. He gets into all of it. He makes it come to life, he makes it real.

Dr. Espinosa stated, “I think that control charts are a way of life. I actually think that we only began, literally, to scratch the surface of the

power of control charts in Health Care if not in life."

Summary of Chapter 4

The results of six in-depth interviews are presented in this chapter. Four organizations were in the service business and two were manufacturers. They varied in size from tiny to very large. In two organizations, one service, the other manufacturing, all quality tools were widely used to operate day-to-day and strategic decision making. It is interesting to note that the organizations that use quality tools extensively also automated their processes using computerized, real-time data presented in a form that is easy to use by the operators. The other firms shied away from the use of these tools as being too technical, unnecessary, etc. The two organizations that used quality tools extensively had champions that truly understood the concept of process as well as a senior managers that also understood the concepts of quality tools.

The table below is a summary of the respondents, whether their formal education or other courses on quality were scientific or not, and whether the organization made extensive use of quality tools.

Table 2

Summary of Organizations Interviewed

Organization	Respondent	Title	Seminar or Science Degree?	Extensive Use of Quality Tools
Bank of New York	D. M. Monks	ESVP	Yes	No
	C. J. Vitiello	SVP	Yes	
	S. D. Thum	VP	Yes	
NY Clearing House	G. F. Thomas	President	No	No
	R. Plummer	VP	No	
	J. B. Molina	Manager	Yes	
MTA Metro-North	P. A. Cannito	President	Yes	No
	H. Permut	VP	Yes	
	R. Butt	CMO	No	
	R. A. Ferretti	Asst. Dir.	Yes	
JoCal	D. A Hepperle	Sales Mgr	No	No
Schiffenhaus	J.A. Schiffenhaus, Jr.	Office of President	Yes	Yes
	G. Natusch	Plt. Sup.	Yes	
	S. J. Long	VP	Yes	
Overlook Hospital	L. Kosnik, RN	CNO	Yes	Yes
	L. Dietterich, RN	Mgr. ED	Yes	
	J. Espinosa, MD	Dir. ED	Yes	

CHAPTER 5

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

This chapter considers the results of the study, reviews the findings and develops conclusions and recommendations.

Results of Study

The study seeks to determine some of the factors that cause managers to select the tools of quality that they use. Based on the writer's experience with some executives such as Mr. Joseph Rice, former chairman of the Irving Trust Company, and Mr. John Reed, retiring chairman of Citicorp, it seemed as though the type of tool used in any particular instance depended on the background of the executive for whom a report on quality is prepared.

A secondary issue was whether there is a difference in the tool selection based on the type of organization, manufacturing or not. Tamimi and Sebastianelli (1996) had students survey both types of businesses and found that "manufacturing firms, as compared to service firms, more often stressed the importance of 'conformance to specifications' and 'quality of workmanship' in defining quality" (p. 35). This led the writer to develop a theory that manufacturing firms use the quantitative tools of

quality more than do service firms.

To test the two theories, a multi-case, embedded design was used; a design called “Type 4" by Dr. Yin (1994, p. 39). Six companies were studied with three to four units in each. The number people interviewed in each case depended on the structure of the organization. The aim was to interview a policy maker, a decision maker, a user and a quality staff person. As it turned out, only one case, MTA Metro-North, was structured to have all four of these positions. The organizational structure of four other business units had a combination of a policy and decision maker in the person of one individual. In one case, Jo-Cal Embroidery, the organization was so small that all four functions were found in the one person interviewed for this case.

An additional conversation was held with Mr. James L. Bailey (EVP of Citibank). Although not a structured interview as used in the six cases reported, Mr. Bailey had a theory of management styles that fit into the theory being developed. Mr. Bailey’s theory was that managers can be classed as one of two types,

1. those who are model oriented (like John Reed, co-chairman of Citicorp) and
2. those who are relationship oriented(like Sandy Weill co-

chairman of Citicorp).

In Mr. Bailey's view, model orientation causes executives to look toward a scientific approach to problem solving. He told the writer that Mr. Reed reviewed the various methods of assuring quality. As part of this process, all of the 90,000 employees were trained in SPC. However, it was a failure since the methods were not used. Currently, the bank uses a version of "six sigma" that is essentially a problem solving system based on the non-technical parts of Ishikawa's seven tools.

Mr. Bailey indicated that those who are relationship oriented use these relationships to solve problems. In the latter case it seems to the writer that it would be easy to slip into the "do it my way or take to the highway" method of managing.

Mr. Bailey's model is very interesting since it explains a great deal of what the writer learned during his interviews. This will be discussed further in the conclusions.

Of the six cases studied only two had a practical, sophisticated process for using quality tools. Interestingly, both of these organizations, Schiffenhaus Packaging and the Emergency Department of Overlook Hospital, used computer technology to make the information operate on a real time basis.

The Jo-Cal Embroidery firm relied entirely on inspection without a reporting system, either paper or automated.

The other three organizations relied on what amounts to, basically, paper reports which are a result of inspections. Great pains are taken in all cases to protect the product integrity. Data is accumulated in these instances, by inspection, surveys or other means, and that data is reduced to numeric tables. These data and their summaries are reviewed by various levels of management and acted upon based on the interpretation of management.

The concept of a difference in management action that depends on knowing whether one deals with special cause or not, was not encountered in the four cases where quality tools were not used extensively. Indeed, when discussing a report with Mr. Monks, of the Bank of New York, he said that he took action when the “number of [problem transactions] had increased in the last quarter rather substantially in dollar value.” The writer asked Mr. Monks, “What is substantial? Where is the dividing line?” Mr. Monks responded with, “Well that is a good question.”

In effect, only two of the six organizations used quality tools to such an extent that they avoid a situation that Deming defined as tampering (Deming, 1994, p. 196-204). Even with the good methods used by

Overlook Hospital, the danger of tampering still exists. However, Dr. Espinosa had a reason for thinking otherwise as cited above.

The two organizations that did use quality tools extensively were a manufacturer and a service organization. The ones that did not use quality tools extensively were two pure service organizations, the Bank of New York and the New York Clearing House's Electronic Payments Network, Jo-Cal Embroidery, a manufacturer, and MTA Metro-North, a mixture of service and manufacturing. Metro-North is essentially a service operation, however, they have such a large component in their maintenance and construction that they might be considered a mixture. While it is true that the maintenance and construction supervision functions have, as their aim, the improvement of service, these activities are dependent on manufacturing control procedures.

Findings

There were two hypotheses formed for this study:

H1: The choice of tools is a function of the personal constructs of management; and

H2: The choice of tools is influenced by whether the organization is in the service or manufacturing industry.

The results of the survey contra-indicated these hypotheses.

Hypothesis 1 Discussed

The results of the case studies were that there appears to be no correlation between the formal and informal studies and the use of quality tools. Since a case can only give indications rather than a stated probability, there might well be situations where a relationship of the type proposed in the first hypothesis can exist. However, the cases were selected with a view of proving this hypothesis. The respondents from the Bank of New York hold degrees in management, economics, accounting and statistics. Furthermore, the all worked in the Quality Control Center when all the tools for quality were in use. Finally, Mr. Monks and Mr. Thum had extensive seminar training in the use of these tools. If the first hypothesis were true, one would expect that this group in particular would use quantitative and qualitative tools of quality. Such was not the case.

In the case of Mr. Cannito, exposure to the tools was a negative to their use instead of a positive. Yet, his formal education included basic and advanced business administration, advanced transportation management and schooling from Tennessee Associates Quality Program in quality and ISO 9000 Certification Training. The manner in which he was exposed to the tools of quality may have had much to do with his rejection of their use.

On the other hand, some expert users of the tools, such as Mr. Schiffenhaus, had non-technical formal training and learned to use the tools of quality by applying them on the job. If the hypothesis were true, one would expect exactly the reverse of what the case studies revealed. As Deming (1994, p. 104) said, “No number of examples establishes a theory, yet a single unexplained failure of a theory requires modification or even abandonment of the theory.” One sees here a theory, hypothesis 1, which failed and therefore requires, at least, modification. The writer will propose some modifications in the conclusions.

Hypothesis 2 Discussed

The second hypothesis stated that the choice of tools is influenced by whether the organization is in the service or manufacturing industry. If one considers the Schiffenhaus Packaging Corporation example together with the Overlook Hospital example one sees that both organizations made extensive use of quality control tools. On the other hand, Jo-Cal Embroidery used no quality tools at all, nor was there an extensive use of these tools in the maintenance operation of Metro-North.

Clearly, this is another case where a single example destroys the theory. The writer consulted with a number of other manufacturing organizations that also did not use quality tools. It therefore seems to the

writer that the hypothesis of the difference in the use of quality tools between manufacturing and service organizations is not as great as it once may have been. The American Society for Quality has a division that is solely concerned with the service area. This may be an indication that any difference with regard to quality tools is disappearing. That is not to say that everyone embraces the use of these tools. The case study indicated that is not the situation. Mr. Cannito, for instance, felt that the quality tools frustrate managers. He based this feeling on his observation that rather than saving costs, “the task of measuring and implementing quality becomes harder than the task that you ultimately perform anyway.” The writer has encountered other executives who held the same opinion in both the service and the manufacturing sectors.

The Findings Compared to Previous Research.

In spite of a fairly substantial search of the literature, the writer located no research that pointed directly to the issues being examined here. The closest item in the literature dealt with the difference in the selection of the definition of quality by service and manufacturing companies.

In a study of the use of Deming’s methods in the Philadelphia area,

Tamimi and Gershon (1995) surveyed 225 service firms and 153 manufacturing firms. The response rates of the two types of firm are nearly the same (47% for service firms and 44% for manufacturers) (p. 30). They do not, however, show the survey results separately by type of firm, nor do they discuss this issue.

In a later survey, Tamimi and Sebastianelli (1996) used students to determine manufacturing firms and service firms define quality differently. While the research also determined how firms measure quality, no comparison was made between the method used, if any, of manufacturing firms and service firms. Therefore, although measures were obtained, no comparison was reported for these measures. The only comparison was for the way quality was defined by manufacturers contrasted to service firms.

The case study adds to our knowledge concerning tool selection and perceived differences between manufacturing firms and service firms.

Because the selection of tools was the same in cases where technical knowledge and training existed vis-a-vis cases where these did not exist, hypothesis 1 did not hold up. Since extensive use of the tools of quality was made in at least one of the service company firms and not the others, and since one manufacturer made extensive use of the quality

tools while the other did not, Hypothesis 2 did not hold up.

Conclusions

There are five general conclusions to be drawn from the case study and the interview with Mr. Bailey of Citicorp. These deal with the following issues:

1. Impact of the Executive
2. Use of Control Charts
3. Training
4. Create Better Understanding of the Tools of Quality
5. Use of Tools in Service Vis-a-vis Manufacturing

Each issue is examined separately below.

Impact of the Executive

It is clear that the executives interviewed are concerned about the quality of their output. They link this closely to how the customer perceives the quality as described by Buzzell and Gale (1987). They recognize the relationship between profit and customer satisfaction. From this recognition comes the desire to deliver the best possible quality.

Some executives, such as Mr. Heperle, have not distinguished between quality as a feature of the product or service and quality as the way the product or service is delivered. This causes them to be concerned with whether they can afford to improve quality, meaning features. They

know that they must deliver the product as promised but consider this as part of the production process.

The writer has encountered the confusion about the type of quality with other executives. It would be worthwhile for the societies that deal with issues of quality, such as the American Society for Quality -- commonly known by its initials. ASQ -- to mount a campaign to clarify the confusion. For a given set of features, customers want production quality, meaning that they want the features of the product delivered as promised.

The interviews indicate that the executives are more concerned with delivering the correct product or service than they are with the process that assures the delivery of such quality products. Consequently, their control procedures measure the product. When things go wrong, they check the process and take action. They feel that action is always justified at the cut-offs that they set. Mr. Monks uses “ a 15% increase in the number of errors” to trigger action. Is 15% the right number? Is 10%? Without the use of a control chart, one does not know. However, this quality tool was used in only two cases.

The concept of process differentiates the modern method of quality control from that used in the 19th century. The cases revealed that in four firms control was established as the inspection of product and feed back

from the customer. This deals with historical events. The concept of quality control proposed by Shewhart (1931) looks for it to “serve as a computing device in making predictions” (p.19). The prediction to which he refers is that the process is delivering acceptable product or service. Shewhart looked at processes, not products or service per se. Of course, one measures the outcomes to make the prediction about which Shewhart writes. In two cases processes were examined for the Shewhart “prediction”, in the other four cases this was not done.

The conclusion that is obtained here is that the selection of adequate tools does not depend so much on the executive’s background as it does upon his understanding and acceptance of the need to work on processes. In the two cases where the tools of quality were used throughout the organization, the executives understood the notion of process. They not only understood this concept but deployed it throughout their organization. Everyone understood it.

The tools that are used do not necessarily come from the top as originally postulated. They seem to come from a champion of the process within the organization that sells the concept in all directions, up (if needed), down and sideways to peers. The champion needs relatively fertile ground to sell the method. He also needs a critical mass of the

organization to support his or her views to enable the process to work. Deming often spoke about the need of this critical mass as described in Latzko and Saunders (1995).

Since the introduction of the idea of process and the quality tools needed for it takes time for acceptance, it takes the champion some time and effort to introduce these ideas so that they become the routine of the organization. The experience discussed by Dr. Espinosa of the dismantling of a good system was also shared by the writer. As the champion leaves or new managers come into the organization, managers that are not trained in process management, they see the effort needed for the controls without understanding the problems that required them in the first place. The result is that they, like Mr. Cannito, see these efforts as costing more than they are worth, so they methods are removed. The consequence of these actions does not take long in appearing. The problems, that were solved using process controls, reappear rather quickly.

Managing processes to produce quality output requires an understanding and acceptance of the use of appropriate tools of quality. This takes time. It is a case of leadership and patience on the part of the champion.

A basic requirement that executives require of the application of the

tools of quality is that they must provide an ultimate benefit (cost reduction, sales increase, or both) resulting in a profit increase. Profit could mean greater utilization of existing resources. Like many investments, it takes time before the methods mature and give the looked for results. This fact must be understood as much as the need to manage the process. It also takes knowledge and skills to develop the process controls to give the results desired. Some people can train themselves as shown by the work done by Dr. Espinosa. Such people are rare and even they need the support of specialists on occasion. Others, such as Mr. Schiffenhaus and Mr. Long, use consultants as well as train themselves as much as possible. Mr. Schiffenhaus started with the Philadelphia Area Chamber for Excellence (PACE) Round Table. This was a group that met with A Deming Master and others to learn various methods and techniques. Later he hired a consultant who worked with him and Mr. Long.

The situation in the two cases represented by Schiffenhaus Packaging and Overlook Hospital shows that the executive needs to be an active participant in the use of the quality tools to make them work. This form of involvement in the quality process sends a strong signal throughout the organization that quality is important and that the tools

supplied by the management need to be used.

Use of Control Charts

Among the dictums that Kaoru Ishikawa (1985) gave us is, “QC begins with a control chart and ends with a control chart” (p. 197).

The control chart, invented by Shewhart (1931) is a tool that allows one to tell if a process consists only of common causes of variation or special causes of variation. Shewhart used the term chance cause and assignable cause. Common or chance causes of variation require management to act on the whole process by making a fundamental change in the process. Special or assignable causes of variation require that worker and/or management work on the special cause only.

Control charts show that the process is stable or predictable when only chance causes are present. Otherwise, it is unstable or not predictable.

Often, standards or specifications are required of the product from a process. If the control chart is stable and product or service meets the specification, the process is stable and “capable”. If the control chart is stable but the product or service does not meet the specification it is called stable but “not capable”. In the latter case, the process may be

predictable but does not give the desired results.

Dr. Donald J. Wheeler (1995) uses the term “conforming” for “capable”. He goes on to show why it is dangerous and sub-optimal to manage a process without a control chart. To show this he develops a matrix for four possible states of a process:

Table 3
“The Four Possibilities for Any Process”

Process Control	Product Produced is	
	Non-Conforming	Conforming
Stable or Predictable	Threshold State	Ideal State
Not Stable or Predictable	State of Chaos	Brink of Chaos

Note: Adopted from Wheeler,D.J. (1995). Advanced topics in statistical process control. Knoxville, TN: SPC Press, p. 9.

Wheeler points out that many systems before they are analyzed and corrected with a control chart contain special or assignable causes of variation. They are either at the “Brink of Chaos” or in a “State of Chaos”. If they are at the “Brink of Chaos”, they tend to slide into the “State of Chaos” by virtue of the force of Entropy. At that point managers take action to correct the situation they see and get back to the state of “Brink of Chaos”. Wheeler calls this situation the “Cycle of Despair”. Wheeler says that there is only one way out,

> There is only one way out of this Cycle of Despair. There is only one way to move a process up to the Threshold State or the Ideal State—and that is to use Shewhart's control charts effectively for process improvement. (p. 12)

Wheeler (2000) summarized this situation in a recent article where he uses less frightening language for the labels in his original book but the results are the same.

If, by accident, the process is stable, chances are very good changes based on a single or few points results in tampering. Deming (1994, p. 172) defines tampering as, "attribute to a special cause any unwanted variation, when in many if not most cases what they observed was variation from common causes." Often, tampering makes the problem worse.

Whether one is caught in Wheeler's Cycle of Despair, or engages in Deming's tampering, changing the process without using a control chart to account for special causes will result in no change at best or making things worse. The lack of knowledge is a cost to the operation.

The use problem solving tools, such as Juran's Management Breakthrough method, without the use of a control chart to determine what action to take, is usually very dangerous for the firm. Yet several of the case studies indicated that this is precisely the basis of their improvement

technique. It may be a situation where certain tools are used indiscriminately.

Mr. Cannito expressed concern with the frustration of managers who are asked to use a technique that takes more of their time than it saves. The two cases where quality methods were used both relied on real time automation to reduce the labor associated with the data collection. The writer feels that methods such as the use of personal computers will go a long way to meeting Mr. Cannito's very valid objections.

Training

A number of training issues surfaced in the case studies. People need to know why they are using tools as well as training them to use these tools. Judging from the results at Citicorp, the training in SPC did not succeed in getting the employees to use this tool in any concerted manner. The writer experienced a similar situation where he was asked to conduct training classes for a mid-size manufacturer in New York State. The president of the company told him that this was their third try at SPC training. He complained that the operators simply do not use it. It turned out that no management level was trained to use SPC, that they

distrusted the method and that they never asked to see any of the charts. They probably would not understand them if they had ask to see the charts. Without management leadership, SPC is an expensive toy.

Training in SPC is important but must be done over a long period. Mr. Long of Schiffenhaus Packaging Corporation showed the writer a course that he bought but would not give to the workers until the management had taken it and was ready to use it.

Any training performed needs to make sense to those being trained. They need to use the tool a few times to gain familiarity with it. It is a little like learning to ride a bicycle. It takes practice to become proficient. Introductory courses do not accomplish this without practice.

An apparent problem is who does the training. It requires a skilled person to impart the knowledge needed for using the tool and it requires follow-up if the tool is to become useful.

Create Better Understanding of the Tools of Quality

It was clear from the cases studied that there was a large amount of misconception about the tools of quality. Some of the misconceptions may arise from what is published in the media read by the respondents, other misconceptions arise from rumors and partial knowledge. Finally,

the way the training is conducted must have some impact on how people view the tools for quality.

The American Society for Quality likes to think of itself as the source of information about quality for the United States. Their strategic plan for the year 2000-01 calls for the following four objectives (From ASQ Item B099), “By 2004, the American Society for Quality will be . . . A worldwide provider of information and learning opportunities related to quality.” In line with this objective, it would seem that the ASQ would be an ideal organization to do the missionary work needed here.

Some comments in the case studies lead the writer to conclude that the Six Sigma method is thought of as statistical when in fact it is nothing more than a new term for continual improvement. Perhaps the reaction of executives like Mr. Cannito is the reason for the Six Sigma Academy reportedly down-playing the use of statistics of any sort and reportedly avoiding the use of quality engineers (personal communication 8 May 2000).

The writer’s conclusion here is that there is much opportunity for ASQ to take a leading role in the promotion of the proper use of the tools for quality.

Another issue deals with the media in which information about the

benefits of quality should be discussed. It seems that most of the information read by the key decision makers are their trade journals and some general magazines dealing with the market place. The *Wall Street Journal* was mentioned a few times as well. Articles in academic journals and quality magazines, while useful, do not seem to reach the audience of executives that need to hear about the methods for managing quality.

Use of Tools in Service Vis-a-vis Manufacturing

The case study showed no difference in the application of quality tools in either the service or the manufacturing sector. The two cases that used the tools effectively represented both types of industry. The methods were certainly useful in both cases.

Further Research

Qualitative research and case study give rich details of the case or cases being studied. The six cases and the single interview gave an insight into the basic study questions. Some additional questions come to mind for further research. Among these is whether there exists a difference in the adoption of control charts by service and manufacturing firms. Ishikawa's dictum and Wheeler's concept cited above indicate that

lack of using control charts can hinder effective application of continual improvement.

Some corollary questions are why control charts are used or not used. In a recent paper, Latzko (2000) cited the low utilization of control charts on the basis of the percentage articles published in the Annual Quality Progress and as listed on ProQuest among other articles on quality. This method may not reflect the actual usage of control charts and does not reflect the percent usage by service and manufacturing firms. Further research in this area will reveal the actual status.

Another area of further research indicated by this work relates to why executives and others use or do not use control charts as well as other tools. Some indications in the present case study indicates that some executives consider the tool too sophisticated for their application, or too time consuming, or are not familiar with its use. Further clarification of this issue would help in structuring methods of introducing control charts to executives.

While there was an indication of which media influence executives concerning the tools of quality, the sample was probably not representative enough to point at a direction in which to publish to gain the executive’s attention.

Implications and Recommendations

This research has shown that the selection of tools of quality seems to depend on the ability of a champion in the organization to understand the concept of process, apply it, and to convince at least a critical mass of other managers and top management that this tool contributes to the well being of the organization.

There appears to be no difference in the application of the tools or the reason for selecting a given tool between service organizations and manufacturing organizations.

The use and need for using the Shewhart Control Chart appears to be little understood by many managers. Many managers do shy away from using control charts and similar statistical tools because they feel that these tools are more costly to apply than the problems that they solve.

The case studies seem to indicate that successful use of control charts requires personal computers or equivalent computing power to decrease the cost of processing the data, get real time information, and get the flexibility to obtain information from data to better understand and, therefore, to better manage the operation.

The management of an operation to obtain quality results requires

as thorough an understanding of the field of quality as it does of accounting, human resource management, and marketing. Schools of management often require accounting and statistics for undergraduate and advanced degrees. This study shows a need to expand this to include management for quality.

In a global marketplace, where other countries emphasize managing for quality, we need to do the same to remain competitive. The study shows that many managers equate managing for quality with problem solving. While problem solving is important, it must be combined with a knowledge of the process to avoid the cycle of despair and tampering. Only the correct use of the control chart can help to accomplish a true cycle of continual improvement for quality, productivity and competitiveness.

Appendix A

Statement via E-mail by Dr. Steven L. Dockstader

Concerning the Origins of the Term “TQM.”

stevedox@worldnet.att.net

18 Mar 1998

Dear Mr. Latzko--

Tom Koslowski at the Navy TQL office directed your question [about the origins of the term “TQM”] to me, and I am happy to provide information for your research.

In the fall of 1984 the Naval Aviation Logistics Command (NALC) had decided to begin "contemporary" practices of quality control at their six overhaul facilities. At the time, I was the head of the research and development team that was providing technical assistance to NALC. Being Industrial Psychologists with considerable background in statistical methods, we had just completed a feasibility study of what was then called Total Quality Control (we had borrowed the term from Dr. Ishikawa's book--translated by David Lu). I had received a pre-publication copy of Ishikawa's book from either Myron Tribus or Bob King, and it was quite clear that it was going to be an important source of information for us to use in development of the NALC "program."

The NALC commander and his staff were not comfortable with Dr. Ishikawa's elaborate description of TQC, and the Commander, in particular, did not like the word "Control." He suggested that we develop something more consistent with the Deming philosophy--which he felt was the approach he wanted to pursue. Given that suggestion, I developed the definition based upon my understanding of Dr. Deming's flow diagram "Production viewed as a system. (Deming, 1986, p. 4)." I consider that diagram as seminal to quality management and have always been proud of the fact that TQM was defined by some of the thinking stimulated by it. The current definition differs from the original in only one significant way: we originally used "customer" in place of "end-user."

The actual title that was developed at the time (July, 1985) was Total Quality Management. As I mentioned, the NALC Commander did not like the word "control." A member of his staff, Ms Nancy Warren, suggested the world "management" instead. Her actual words were: "Deming is talking about management, why don't we call it 'Total Quality Management'?

We had performed a rather extensive literature review in 1984 and could find no reference to the term "Total Quality Management," and so we quite rightly felt that (a) we have coined the phrase and (b) defined it. I

understand that there has been some debate as to whether TQM had been used prior to July 1985, but I can assure you that it wasn't in the Defense Department. The NALC Commander, [Rear Admiral] John Kirkpatrick, and I introduced the concept and the definition to other naval and DoD [Department of Defense] officials during the fall of that year and we never heard any reference to the term in any context other than our own until sometime later.

TQM was re-named TQL in 1991 when the military head of the Navy, [Admiral] Frank Kelso, commented that naval "warriors" did not like to be regarded as "managers." His point was that, if we wanted this to be adopted by the military community (it had been largely relegated to the civilian-dominated logistics community), then it would have to be cast as "leadership." The term was then changed--but the definition remained the same until "end-user" was substituted for "customer" later that same year.

[Later, Dr. Dockstader sent a clarification to Professor Joseph Kelada of the HEC Business School University of Montreal. Below is a copy of this message dated 26 Mar 1998.]

I don't know that we can lay claim to the term, Total Quality Management, but it certainly wasn't visible in the management literature at the time we defined it in the Department of the Navy.

The term, and its definition, were worked out by myself, CAPT Wayne Putnam, and Ms. Nancy Warren in July of 1985. CAPT Putnam and Nancy Warren were staff assistants to RADM John Kirkpatrick who was in charge of the Navy aircraft overhaul facilities. At the time, I was in charge of a team of industrial and organizational psychologists that had been tasked by [Rear Admiral] Kirkpatrick to develop an implementation system for the practice of quality improvement in his six depots. During this particular meeting in July we were working to develop an appropriate definition and title for the effort. Due to the fact that RADM Kirkpatrick and his staff had been exposed to Deming's philosophy, they felt that it should be reflected in the definition.

My research team had done an in-depth analysis of the literature available at the time and we had spent numerous meetings trying to understand the relationship between Total Quality Control and what it was that Deming was presenting in his 4-day seminar. It soon became clear that Deming was applying systems concepts to organizations and that perhaps the most seminal of his teachings was that of "Production viewed as a system" which is diagramed on p.4 of "Out of the Crisis." This would become the inspiration for the definition.

In the July meeting with Putnam and Warren, I offered a candidate

description of "total" quality as "an organization-wide approach to meet or exceed the needs of the marketplace based upon the systems view organizations and a humanistic view of the nature of people." May 1984.

There was much discussion of particular words based upon their perceived acceptability in the military-industrial culture. Eventually, we came up with the following: "the application of statistical methods and people to assess and improve materials and services supplied to our organizations, all significant processes within our organizations, and meeting the needs of the customer, now and in the future." (July 1985.) It may be something of a stretch to relate that to Deming's flow diagram, but we found it to be a good and useful description.

Having worked out this description/definition, we still did not have a label for it. My view was that we should leave it as a variant of the term Total Quality Control (the Ishikawa version, not the Feigenbaum version) because if we put a label on it, it would become branded as a program as opposed to a system of management. I lost the argument, but was able to retain the "Total Quality" part. There were troublesome connotations associated with "control," because of the (un)popular usage of the term. Nancy Warren hit the nail on the head when she suggested the term "Management," because she felt that it was most faithful to Deming's

message. "Total Quality Management" was presented to [Rear Admiral] John Kirkpatrick that same day, along with the details of the definition and the wordsmithing that had transpired.

The definition has since received additional smithing. Problems with the words "statistical" and "customer," and specific reference to the "knowledge of" people have resulted in the current definition, which is now referred to as Total Quality Leadership: "TQL is defined as the application of quantitative methods and the knowledge of people to assess and improve (a) materials and services supplied to the organization, (b) all significant processes within the organization, and (c) meeting the needs of the end-user, now and in the future."

The term "leadership" was substituted for management by the Chief of Naval Operations, Admiral Frank Kelso. It was his view that the term leadership was (a) more appropriate to the naval culture and (b) required to achieve transformational change. The definition, however, was not changed when TQM became TQL.

Some of this history is covered in "Deming Management at Work" by Mary Walton (Putnam, 1991) and "Thinking About Quality" by Dobyns and Crawford-Mason (Random House/Times Books, 1994). Hope this is useful, Steve Dockstader

Appendix B

Listed below is a table of tools (T) and methods (M), sometimes called techniques, related to TQM. The tools or methods are listed alphabetically by (a) methods that define processes, (b) tools that define processes, (c) methods that control process, (d) stochastic tools, and (g) non-stochastic tools.

Stochastic as used in Table B.1 means that the method or tool is based on some statistical theory or random variate. Non-stochastic means that some mathematical analysis is involved that does not depend on statistical theory.

Following the table is a brief description of each tool or method. Often, methods use one or more of the tools that are listed in the table.

TABLE 4.
List of Tools and Methods for TQM by Type

Tool or Method	(*)	Qualitative		Quantitative	
		Defining Process	Control Process	Sto-chastic	Non-Stochastic
Active Listening	T	X			
Affinity Diagram	T	X			
Arrow (PERT, CPM, Activ-ity Network) Diagram	T	X			
Auditing	M		X		
Bar Charts	T				X

Tool or Method	(*)	Qualitative		Quantitative	
		Defining Process	Control Process	Sto-chastic	Non-Stochastic
Benchmarking	M	X			
Brainstorming	T	X			
Cause and effect diagram	T	X			
Check sheets	T				X
Concurrent engineering	M	X			
Control charts and graphs	T			X	
Delphi technique	T	X			
Deming cycle	M	X			
Design of experiments	T			X	
Evolutionary operation	T			X	
Failure mode analysis	M		X		
Failure mode, effects, and criticality analysis FMECA, FMEA, PDPC	T			X	
Flowcharts	T	X			
Foolproofing (Poka-yoke)	M	X			
Force field analysis	T	X			
Histogram	T			X	
Hoshin kanri (Quality Pol-icy Deployment)	M		X		
Imagineering	M	X			
Input/Output Analysis	M	X			

Tool or Method	(*)	Qualitative		Quantitative	
		Defining Process	Control Process	Sto-chastic	Non-Stochastic
ISO 9000	M		X		
Just in time (JIT)	M		X		
Loss function	T				X
Matrix data analysis (Priori-tization Matrices)	T			X	
Matrix Diagram	T	X			
Nominal group techniques	T	X			
Pareto analysis	T				X
Pie chart	T				X
Process decision program chart (PDPC), FMEA	T	X			
Process capability	T			X	
Quality function deploy-ment (QFD)	T				X
Quality control circles	M	X			
Quality improvement teams	M	X			
Quality costs	T				X
Regression analysis	T			X	
Relation diagram (Interrelations Digraph)	T	X			
Reliability analysis	T			X	
Run Charts	T				X

Tool or Method	(*)	Qualitative		Quantitative	
		Defining Process	Control Process	Sto-chastic	Non-Stochastic
Sampling, Enumerative	T			X	
Sampling, acceptance	T			X	
Scatter Diagram	T			X	
Self managing work teams	M		X		
Simulation	T	X			
Statistics, Descriptive	T			X	
Statistics, Analytic	T			X	
Stratification	T				X
Systematic diagram (Tree Diagram)	T	X			
Systems analysis	M	X			
Taguchi DOE	T			X	
Task forces	M	X			
Team Building	M	X			
Time series forecasting	T	X			
Total productive maintenance	M		X		

* This column uses M for Method and T for tool

Below is a short description of each of the tools and methods listed. In some cases, there is overlap in that the same tool (e.g. Pareto Analysis) is used in several of the methods. In some cases, what is listed as a

tool may be a family of tools that are so similar that they are usually listed as a family rather than individually. The list is alphabetic.

Active Listening - A behavioral methods tool listed by Stoner and Werner (1994). The implication of active is to hear and understand what is being said.

Affinity Diagram - This is one of the “Seven New Tools.” Brassard (1989) says, “This tool gathers large amount of language data (ideas, opinions, issues, etc.) and organizes it into groupings based on natural relationships between each item. It is similar to the process of coding in qualitative data analysis such as grounded theory. It should be noted that it also is called “KJ Method©” after its originator Jiro Kawakita.

Arrow Diagram - This is one of the “Seven New Tools” based on the concept of Critical Path Method (CPM) of network graphing. It is primarily a production control tool.

Auditing - Hutchins (1992) defines audit as an “independent, structured, detailed, and documented evaluation of an activity” (p. 432).

Bar Chart - A graph where frequencies of observations are represented by the length of the bar.

Benchmarking - Adopting the best in class business methods to one’s own activities.

Brainstorming - A group process in which ideas are generated. There are a number of approaches to brainstorming that go by various names such as Nominal Group Technique, Delphi Method, etc.

Cause and Effect Diagram - This method is a form of brainstorming aided by a graphic display of all the causes for a particular effect. A central arrow points to the effect. Secondary vertical arrows point to the central horizontal arrow. The secondary arrows are frequently labeled “Method”, “Material”, “Machine”, “Environment”, and “People”. This is one of the “Seven Basic Tools.” It is also known as Ishikawa Diagram (after the inventor) or Fishbone Diagram (after the appearance of finished diagrams)

Check Sheets - This tool is used to record the number of event occurrence. It is one of the “Seven Basic Tools.”

Concurrent Engineering - This is a method used to coordinate the Customer, design, and production and marketing needs. The main tool in this process is the Quality Function Deployment.

Control Charts and Graphs - Part of the “Seven Basic Tools”, graphs are a way to illustrate numeric data in a way that makes them more understandable to people. A special subset of graphs are the control charts. Invented by Walter Shewhart, control charts are an operational

definition of special causes. All Shewhart charts are distinguished by three horizontal parallel lines known as the Upper Control Limit (UCL), Center Line (CL), and Lower Control Limit (LCL). The abscissa is a time scale while the ordinate is a value scale. Observations taken in sequence are plotted one after the other. Any observation falling on or outside the UCL or LCL is considered a special cause of variation. Any non-random point within the limits is also considered a special cause. All other points are called common causes of variation. The UCL and LCL are computed from the data plotted or are based on past data. There are other types of control charts such as the Cumulative Sum Chart.

Delphi Technique - This method can be characterized as a form of long distance brainstorming. Ideas on a topic are chosen and circulated to participants. Additional ideas are received and circulated again, The process continues until a consensus is reached.

Deming Cycle - It should be noted that Dr. Deming objected to this term saying it should be called the Shewhart Cycle. There are in fact two cycles. One is the consumer cycle. This is a continual loop of four activities, design, make, sell, test in service, use the results to restart the loop. The second is the cycle of learning: Plan, do, study, act.

Design of experiments (DOE) - This is a method to try a combina-

tion of factors at various levels measuring the results of each combination. From this one can analyze which factor or level, if any, yielded the best results. The method accounts for the sampling variation in making this determination.

Evolutionary Operation Processing (EVOP) - Invented by Dr. Box, this is a variation on the Design of Experiment (DOE). Usually DOE requires off line experimentation. In EVOP the experiment is made as part of the production process varying the factors within the tolerance levels. If an optimum set of levels are found, these become the new standard and the process is repeated until no further benefit is gained. The process allows useable production to be made while experimenting,

Failure Mode Analysis (FMA) - Campbell (1998) defines this as “A procedure to determine which malfunction symptoms appear immediately before or after a failure of a critical parameter in a system. After all the possible causes are listed for each symptom, the product is designed to eliminate the problems” (p. 54).

Failure Mode Effects and Criticality Analysis (FMECA) - Usually, systems are interactive. The FMA finds and corrects the problem in one source area of a system. The Failure Mode Effects Analysis (FMEA) looks at the interaction effects of one or more FMA’s. The FMECA goes one

step further in investigating not only the potential failures but assigning a probability to each to assess the criticality of all potential failures. This is what the Process Decision Program Chart does as well.

Flowcharts - This is a graphic way of describing a process using a set of standard shapes to indicate the nature of each step.

Fool-proofing - This is similar to FMEA in looking at all possible places where mistakes can occur and finding ways to eliminate these mistakes. The process was invented by Shigeo Shingo (1986) who originally called it *baka-yoke* (fool proofing) but changed it to *poka-yoke* (mistake proofing) when he found workers where adversely affected by the word “fool” (p. 45).

Force field analysis - A listing of all positive and negative forces impacting a process. Each vector, whether positive or negative is assigned a weight. The function of this process is to identify the negative aspects so that they can be removed, and the positive aspects so that they can be reinforced.

Histogram - A chart where frequency is represented by the area of a rectangle.

Hoshin kanri - Also known as Quality Policy Deployment it is a form of management by planning. Top management sets objectives to accom-

plish the aim of the organization. Each area of the organization states how they plan to meet these objectives and what resources they need to do so. If the plan and resources are agreed upon, the plan is put into operation. Top management frequently (monthly or more) reviews the achievements and sees if the plan worked or needs change. The focus is on the plan, not the employee.

Imagineering - A term coined by Bill Conway that requires thinking of alternatives for improvement. It is sometimes referred to as “thinking out of the box” meaning that one should not be constrained by current boundaries.

Input/Output Analysis - A statement of all resources (inputs) required to create a product (output) from a process. It shows the relation of inputs to outputs. Its purpose is to make clear everyone’s role and remove unnecessary redundancies.

ISO 9000 - This is a set of procedures (9000 -9004, and 14000) that specify what actions must be taken to achieve quality in an organization. It is essentially a procedure that can be audited and if it meets the criterion set forth in the procedure can be given approval. Questions have been raised whether the standard is doing what it wants to accomplish (Zuckerman, 1994).

Just in time (JIT) - A method to reduce in-process-inventory that requires supplies to arrive just as they are needed.

Loss function - Popularized by Professor Taguchi, this curve shows the “loss to society” that is incurred as a process deviates from a nominal value. (see Taguchi, 1981)

Matrix data analysis - This is one of the Seven Tools of Management. Mizuno (1988) uses multivariate methods such as factor analysis to evaluate quantitative information in a matrix. Brassard (1989) replaces this method with “prioritization matrices” because he feels that it is just a subset of multivariate analysis (p. 97). His format is the quantitative tool used in Quality Function Deployment.

Matrix Diagram - This is one of the Seven Tools of Management. It is a row and column format, a table, for displaying data. Its condensed form makes the data more meaningful.

Nominal group technique (NGT) - A method of structured brainstorming that uses four phases, (a) silent generation of ideas on paper, (b) round robin paging where everyone gives one idea or passes as their turn arises, (c) clarification to achieve common understanding of all ideas, and (d) voting to develop key ideas. The last step is optional.

Pareto analysis - This is one of the Seven Basic Tools. Invented by

J. M. Juran--who named this concept after Vilfredo Pareto, an Italian economist--ranks problems areas in order of their contribution to the main problem. The purpose is to select the vital few problems and leave the useful many to a later time. It is said that 80% of the contribution arises from 20% of the problem areas. Concentration on this 20% is far more productive than concentration on the remainder.

Pie chart - A graphic display of data in a circular form. Each wedge or slice of the pie is sized according to the frequency it represents.

Process Decision Program Chart (PDPC) - This is one of the Seven Tools of Management. Essentially it is a Failure Mode Effects and criticality analysis (see above).

Process capability - The limits within which a process can produce output.

Quality function deployment (QFD) - A method for resolving conflicts and setting specifications for new product design. It is the basis for concurrent engineering.

Quality Control Circles - Started by Ishikawa in Japan it is a small group of employees in an area who undertake to solve a problem causing poor quality in their operation.

Quality improvement teams - Similar to quality control circles these

teams solve problem causing poor quality. They can be a small group from an area or a cross functional group covering several areas.

Quality costs - A concept that control four basic elements will optimize profits. The four elements are (a) appraisal cost, the cost of checking for errors, (b) internal failure costs, the cost of correcting errors before they leave the area, (c) external failure costs, the cost of correcting errors after they leave the department, and (d) prevention costs, the cost incurred in trying to prevent failures from occurring. Not considered are two other costs connected with (a) the customer and (b) the employee.

Regression analysis - Regression analysis fits a line or curve to a set of data to describe the data. A coefficient may be computed that shows how much better the regression curve fits the data than a line drawn at Y = the mean. Test, such as Fisher's z test can be performed to see if the coefficient is significant, that is useful, or not. If more than one set of data determines the outcome, a multivariate method called multiple regression can be used to model the data.

Relations Diagram - This is one of the Seven Tools of Management. Called Interrelations Digraph by Brassard (1989) it shows the interrelationship among a number of activities. By tracing inflow and outflow, one can find the root or roots of the process,

Reliability analysis - A method of measuring how long an element in a system is likely to survive when used under the conditions for which it was designed. To keep the system operating longer, additional elements can be added in parallel, a concept called “redundancy”. It also covers the probability of survival. The so-called “bathtub” curve is used to trace the failure rate. Early on the rate is generally high due to flaws in the elements. This is followed by a long period of low probability of failure until at the end of the useful life the probability of failure rises again due to burn out.

Run charts - Part of the Seven Basic Tools, this is a plot of the data in time sequence. A mean or median is often plotted to detect process shifts.

Sampling, enumerative - This is a method for taking a subset of a group of elements and examining them to determine values that are an estimate of what would have been found if all elements had been measured in the same way, a “complete count”. If performed according to sample theory, one can estimate the limits within which the complete count can be expected to fall.

Sampling, acceptance - A method of taking a sample from a lot of product and accepting or rejecting the lot based on some standard. A

theoretical curve called the “Operating Characteristic” (OC) curve can be developed that shows what is the probability of acceptance for a given plan if the actual lot percent non-conforming is a value p. There are two risks involved. The producer risks that some lots whose value is p or better is rejected due to sampling error. The consumer risks accepting some lots whose actual value is more than p based on the sampling plan. The OC curve specifies these risks for any given plan.

Scatter diagram - This is one of the Seven Basic Tools. Data is displayed on an XY axis similar to the use of map coordinates. The ensuing pattern gives some notion to the strength of a linear relationship. A first order regression line fitted to the data and evaluated by its coefficient can show mathematically if the relationship is useful.

Self managing work teams - A group of workers who accomplish a given objective in their way with minimal control from management.

Simulation - Substituting one thing for another. In operations, it generally means building a model (mathematical or otherwise) to experiment with the model to see what will happen under a variety of conditions. This allows decision making under uncertainty. Simulation is usually not as precise as actual computation but can give useful decision making information.

Statistics, descriptive - This refers to the basic enumerative procedures of mean, standard deviation of a sample, etc. A small set of numbers can be used to describe a large set.

Statistics, analytic - This refers to a series of test methods that determines which method(s) is better. It is often called hypothesis testing since a hypothesis is formed and the test designed to accept or reject it. When the data is used to predict future outcomes, this form of testing is analytic.

Stratification - This is one of the Seven Basic Tools. As a basic tool it implies that the data plotted in a scatter diagram be subdivided by logical strata. When each strata is plotted with a different mark, patterns tend to emerge that were hidden when the data was plotted as a single unit.

Systematic diagram - This is one of the Seven Tools of Management. It is also called “tree diagram” based on the shape of the diagram which appears like a tree laid sideways. An organization charts is a form of tree diagram. Successor and predecessor activities are shown by boxes and arrows.

Systems analysis - A method of looking at a process and documenting its order of precedence and decisions. A tool for this process is a flow

chart briefly described above.

Taguchi DOE - Professor Taguchi developed an engineering approach to design of experiments. Using the loss function as an outcome measure, he experiments with varying conditions to find the best. Professor Box has been critical of this method saying that it is inefficient.

Task forces - A group charged with solving a specific problem. It can be differentiated from a quality improvement team (QIT) in that a task force is formed ad hoc for a single purpose while the QIT is an ongoing group.

Appendix C

Interview Guide

The research deals with the connection of an individual's background and their choice of tools for quality. The purpose of the interview is to get information concerning how the tools of quality are perceived by various levels of management and staff and how this relates to their background and environment.

Policy and Decision Maker Questions

0.Introduction

1.Explanation of research objectives

2.Get correct spelling of name

3. Get correct job title

0.Request to record for accuracy

0.Assurance of privacy - can review record.

0.Background - Formal Education

1. School(s) and Studies(s)
2. Degree(s)
3. Other special degree programs such as Stonier, or alternative studies.
4. Certifications such as Bar Exam, CPA, etc.

9. Background - Informal Education related to quality in any way.
    1. Seminars or study courses related to quality.
    2. Internal and/or other training related to quality.
10. Respondent’s source of information on issues of quality.
    1. Newspapers
        i. Financial
        ii. General
    2. General media
    3. Industry media
    4. Books
    5. Video/audio tapes
    6. Other executives
    7. Other
11. Respondent’s definition of TQM.
12. Respondent’s view on quality?
    1. Definition or description of what is meant by quality.
    2. What value does quality have to the organization?
        i. Is this based on perception or data?
        ii. If data, can it be shared.

3. How does respondent see his/her role in achieving the desired quality?

13. How does respondent determine desired quality levels?

14. How does respondent determine that desired quality levels are maintained?

    1. Use external or internal consultants for quality aspect of business?

15. Reports related to quality

    1. Reports used by respondent (copy of report format if possible).

    2. Why did respondent chose the reports on quality that are used?

        i. Were alternatives considered and , if so, why were they rejected?

    3. When and how often are these reports issued to respondent?

    4. What actions are taken based on the quality issues?

    5. Who designed the reports related to quality?

    6. Who prepares the reports related to quality?

16. Control System other than reports.

1. What constitutes success in achieving desired quality levels.

17. What quality tools can the respondent name offhand?
    1. Which of these does the respondent believe to be used in the organization?
    2. What value (if any) is associated with these tools?
18. Other thoughts or advice that the respondent has on the topic.

Support Group Questions

1. Introduction
    1. Explanation of research objectives
    2. Get correct spelling of name
    3. Get correct job title
2. Request to record for accuracy
3. Assurance of privacy - can review record.
4. Background - Formal Education
    1. School(s) and Studies(s)
    2. Degree(s)
    3. Other special degree programs such as Stonier, or alternative studies.

4. Certifications such as Bar Exam, CPA, etc.

5. Background - Informal Education related to quality in any way.
    1. Seminars or study courses related to quality.
    2. Internal and/or other training related to quality.

6. Respondent's source of information on issues of quality.
    1. Newspapers
        i. Financial
        ii. General
    2. General media
    3. Industry media
    4. Books
    5. Video/audio tapes
    6. Other managers or associates
    7. Other

7. Respondent's definition of TQM.

8. Respondent's view on quality?
    1. Definition or description of what is meant by quality.
    2. What value does quality have to the organization?
        i. Is this based on perception or data?

ii. If data, can it be shared.

3. How does respondent see his/her role in achieving the desired quality?

9. How does respondent determine desired quality levels?

10. How does respondent determine that desired quality levels are maintained?

1. Use external or internal consultants for quality aspect of business?

11. Reports related to quality

1. Reports used by respondent (copy of report format if possible).

2. Why did respondent chose the reports on quality that are used?

i. Were alternatives considered and , if so, why were they rejected?

3. When and how often are these reports issued to respondent?

4. What actions are taken based on the quality issues?

5. Who designed the reports related to quality?

6. Who prepares the reports related to quality?

7. Does respondent prepare reports related to quality for next level management?
8. Are these reports written, oral, or both. (If exist, try to get format, issues covered, or copy)

12. Control System other than reports.
    1. What constitutes success in achieving desired quality levels?
    2. What is the respondent's function in any such process?
13. What quality tools can the respondent name offhand?
    1. Which of these does the respondent believe to be used in the organization?
    2. What value (if any) is associated with these tools?
14. Other thoughts or advice that the respondent has on the topic.

Staff Questions

1. Introduction
    1. Explanation of research objectives
    2. Get correct spelling of name
    3. Get correct job title

2. Request to record for accuracy
3. Assurance of privacy - can review record.
4. Background - Formal Education
    1. School(s) and Studies(s)
    2. Degree(s)
    3. Other special degree programs such as Stonier, or alternative studies.
    4. Certifications such as Bar Exam, CPA, etc.
5. Background - Informal Education related to quality in any way.
    1. Seminars or study courses related to quality.
    2. Internal and/or other training related to quality.
6. Respondent’s source of information on issues of quality.
    1. Newspapers
        i. Financial
        ii. General
    2. General media
    3. Industry media
    4. Books
    5. Video/audio tapes

6. Other employees

7. Other

7. Respondent's definition of TQM.

    1. Is there an official organization definition?

    2. Is this the organization's definition?

8. Respondent's view on quality?

    1. Definition or description of what is meant by quality.

    2. What value does quality have to the department?

        i. Is this based on perception or data?

        ii. If data, can it be shared.

    3. How does respondent see his/her role in achieving the desired quality?

9. How does respondent determine desired quality levels?

10. How does respondent determine that desired quality levels are maintained?

    1. Use external or internal consultants for quality aspect of business?

11. Reports related to quality

    1. Reports used by respondent (copy of report format if possible).

2. Why did respondent chose the reports on quality that are used?

   i. Were alternatives considered and , if so, why were they rejected?

3. When and how often are these reports issued to respondent?

4. What actions are taken based on the quality issues?

5. Who designed the reports related to quality?

6. Who prepares the reports related to quality?

7. Does respondent prepare reports related to quality for next level management?

8. Are these reports written, oral, or both. (If exist, try to get format, issues covered, or copy)

12. Control System other than reports.

    1. What constitutes success in achieving desired quality levels?

    2. What is the respondent's function in any such process?

13. What quality tools can the respondent name offhand?

    1. Which of these does the respondent believe to be

used in the department?

2. What value (if any) is associated with these tools?

14. Other thoughts or advice that the respondent has on the topic.

References

Abrahamson, E. (1996). Management fashion. Academy of Management Review, 21, 254-285.

Adam, E. E., Hershauer, J. C., & Ruch, W. A. (1978). Measuring the quality dimension of service productivity (Rep. No. APR 76-07140). Washington, DC: National Science Foundation.

Akers, J. F., Allaire, P. A., Artz, E. L., Galvin, R. W., Poling, H. A., & Robinson, J. D. (1991). An Open Letter: TQM on the Campus. Harvard Business Review, 69, 94-95.

American Quality Foundation & Ernst & Young (1991). The definitive study of the best international quality management practices (Rep. No. I Top Line findings). Cleveland, OH: Ernst & Young.

Anonymous. Quality gets top billing. Quality 23[2], 44-45. 1984. Ref Type: Abstract

Anonymous (1994). People of quality: A profile of the senior TQM executive. Journal of European Industrial Training, 18, 39-40.

Anonymous (1998, February 16). Great Performances: Saluting the national winners of Arthur Anderson's Enterprise Awards for best business practices. Fortune, 137, S1-S2.

Anschutz, E. E. (1995). TQM America. Bradenton. FL: McGuinn & McGuire Publishing.

Barley, S. R., Meyer, G. W., & Gash, D. C. (1988). Cultures of culture: Academics, practitioners and the pragmatics of normative control. Administrative Science Quarterly, 33, 24-60.

Barrow, J. W. (1993). Does total quality management equal organizational learning? Quality Progress, 26, 39-43.

Bemowski, K. (1993). Ceremony honors the 1992 Baldrige Award recipients. Quality Progress, 26, 27-30.

Berwick, D. M. Spreading Change. 1998.

Ref Type: Unpublished Work

Brassard, M. (1989). The memory jogger + (TM). Methuan, MA: GOAL/QPC.

Brocato, R. (1994). Using TQM Methods to Teach TQM: A case study at an Evening Center of the Johns Hopkins University G.W.C. Whiting School of Engineering. Ph. D. Management, The Johns Hopkins University G. W. C. Whiting School of Engineering.

Brocka, B. & Brocka, M. S. (1992). Quality management: implementing the best ideas of the masters. Homestead, IL: Richard D. Irwin.

Broka, B. & Broka, M. S. (1992). Quality Management: Implementing the best ideas of the masters. Homewood, IL: Business One Irwin.

Brown, M. G., Hitchcock, D. E., & Willard, M. L. (1994). Why TQM fails and what to do about it. Burr Ridge, IL: Irwin Professional Pub.

Buzzell, R. D. & Gale, B. T. (1987). The PIMS principles. New York: The Free Press.

Campbell, H. (1998). Quality Management Systems: A glossary of Keywords. In The Essence of Quality Management: Anthology (pp. 47-65). Milwaukee, WI: Quality Press.

Choi, T. Y. & Behling, O. C. (1997). Top managers and TQM success: One more look after all these years. Academy of Management Executive, 11, 37-47.

Cole, R. E. California Management Review 35[3]. 1993.
Ref Type: Journal (Full)

Collins, F. C. J. (1994). Quality: The Ball in Your Court. (2nd ed.) Milwaukee, WI: ASQC Quality Press.

Collins, P. (1994). Approaches to quality. TQM Magazine, 6, 39-43.

Corns, M. C. (1968). The practical operation and management of a bank. (2nd ed.) Boston, MA: Bankers Publishing Company.

Cowden, D. J. (1957). Statistical methods in quality control. Englewood Cliffs, NJ: Prentice-Hall.

Crawford-Mason, C., Frank, R., Lockhart, R., & Dobyns, L. If Japan can. . .why can't we? Dobyns, Lloyd. 1980. New York, NBC.
Ref Type: Video Recording

Crosby, P. B. (1979). Quality is free. New York: McGraw-Hill.

Crouch, J. M. (1992). An ounce of application is worth a ton of abstractions: A practical guide to implementing Total Quality Management. Greensboro, N.C.: LEADS Corporation and Piedmont Pub. Partners.

Dean, J. W. J. & Bowen, D. E. Academy of Management Review 19[3]. 1994.
Ref Type: Journal (Full)

Dean, J. W. J. & Bowen, D. E. (1994a). Management theory and total quality: Improving research and practice through theory development. Academy of Management Review, 19, 392-418.

Deleryd, M., Deltin, J., & Klefsjö, B. (1999). Critical factors for successful implementation of process capability studies. Quality Management Journal, 6, 40-50.

Deming, W. E. (1950). Some theory of sampling. New York: John Wiley & Sons.

Deming, W. E. (1951). Elementary principles of the statistical control of quality. (2nd printing ed.) Tokyo: Nippon Kagaku Gijutsu Remmei (The Union of Japanese Scientists and Engineers).

Deming, W. E. (1960). Sample design in business research. New York: John Wiley & Sons.

Deming, W. E. (1976). On the use of judgement samples. Reports of Statistical Applications [B Section] (JUSE), 23, 25-31.

Deming, W. E. (1982). Quality, productivity, and competitive position. Cambridge, MA: MIT Center for Advanced Engineering Studies.

Deming, W. E. (1992). Out of the crisis. Cambridge, MA: Massachusetts Institute of Technology, Center for Advanced Engineering Study.

Deming, W. E. (1994). The new economics for Industry, Government, Education. (2nd ed.) Cambridge, MA: Massachusetts Institute of Technology, Center for Advanced Engineering Study.

Deming, W. E. & Geoffrey, L. (1941). On sample inspection in the processing of cencus returns. Journal of the American Statistical Association, 36, 351-360.

Deming, W. E. & Hansen, M. H. (1950). On an important limitation to the use of data from samples. Bulletin de l'institute international de statistique, 22, 214-219.

Dewar, D. L. (1980). The quality circle guide to participate management. Englewood Cliffs, NJ: Prentice-Hall.

Dobbins, R. D. (1995). A failure of methods, not philosophy. Quality Progress, 28, 31-33.

Dobyns, L. & Crawford-Mason, C. (1994). Thinking about quality: progress, wisdom and the Deming Philosophy. New York: Random House.

Drummond, H. (1992). The quality movement : what total quality management is really all about! London: Kogan Page Limited.

Duncan, A. J. (1974). Quality control and industrial statistics. (4th ed.) Homewood, IL: Irwin.

Easton, G. S. & Jarrell, S. L. The emerging academic research on the link between total quality management and corporate financial performance: A critical review. 1-45. 1997. Atlanta, GA, Goizueta Business School, Emory University.

Easton, G. S. & Jarrell, S. L. (1998). The effects of Totatal Quality Management on corporate performance: An empirical investigation. Journal of Business, 71, 253-307.

Eggleston, W. W. (1991). Observations, Basic Beliefs, and Process

Management at IBM. In R.J.Pierce (Ed.), Leadership, perspective, and restructuring for total quality : an essential instrument to improve market share and productivity by emminent leaders of America's most competitive companies. (Milwaukee, WI: ASQC Quality Press.

Eskildson, L. (1995). TQM's role in corporate success: Analyzing the evidence. National Productivity Review [NLP], 14, 25-38.

Evans, J. R. & Lindsay, W. M. (1996). The management and control of quality. St. Paul, MN: West Publishing.

Feigenbaum, A. V. (1961). Total quality control. New York: McGraw-Hill.

Feinberg, S. (1995). Overcoming the real issues of implementation. Quality Progress, 28, 79-81.

Forbes, P. S. (1992). Deming's Rules of Good Management. Association Digest.

Fowler, H. W. (1954). A dictionary of modern English usage. (Revised ed.) London: Oxford university Press.

Fowlkes, W. Y. & Creveling, C. M. (1995). Engineering methods for robust quality design: Using Taguchi methods in technology and product development. Reading, MA: Addison-Wesley.

Gibson, J. L., Ivancevich, J. M., & Donnelly, J. H. (1994). Organizations. (8 ed.) Burr Ridge, IL: Irwin.

Ginnodo, W. L. (1992). How TQM is redefining management and leadership. Tapping the Network Journal, 3, 8-10.

Goldberg, S. B. (1993). The Quest for TQM: Love it or hate it, it's impossible to ignore. ABA Journal, 79, 52-57.

Grant, E. L. (1964). Statistical quality control. (3rd ed.) New York: McGraw-Hill.

Grant, R. M., Shani, R., & Krishnan, R. (1994). TQM's challenge to management theory and practice. Sloan Management Review [SMZ], 35,

25-35.

Guerdan, R. (1956). Byzantium, its triumphs and tragedy (D. L. B. Hartley, Trans.). London: Allan & Unwin.

Hackman, J. R. & Wageman, R. (1995). Total quality management: Empirical, conceptual, and practical issues. Administrative Science Quarterly, 40, 309-342.

Hambrick, D. C. (1994). What if the Academy actually mattered? Academy of Management Review, 19, 11-16.

Hammer, M. & Champy, J. (1993). Reengineering the corporation: a manifesto for business revolution. New York: HarperCollins.

Hartman, S. W. (1997). Management. In J.K.Shim, J. G. Siegel, & A. J. Simon (Eds.), The vest-pocket MBA (2nd ed. ed., pp. 293-382). Paramus, NJ: Prentice Hall.

Heaphy, M. S. & Gruska Gregory F. (1995). The Malcolm Baldrige National Quality Award: A yardstick for quality growth. Reading, MA: Addison-Wesley.

Hessel, M. P., Mooney, M., & Zeleny, M. (1988). Integrated process management: A mangement technology for the new competitive era. In M.K.Starr (Ed.), Global Competitiveness: Getting the U.S. back on track (pp. 121-158). New York: W. W. Norton.

Hiam, A. (1993). Does quality work? A review of relevant studies (Rep. No. 1043). New York: The Conference Board.

Houston, A. & Dockstader, S. L. (1996). Total Quality Leadership: A primer Washington, DC: U.S. Department of the Navy. Total Quality Leadership Office.

Hutchins, G. (1992). Standard manual of quality auditing. Prentice Hall.

Ishikawa, K. (1983). Guide to quality control. (2nd. rev. ed.) Tokyo: Asian Productivity Organization.

Ishikawa, K. (1985). What is total quality control?: The Japanese way (D. J. Lu, Trans.). Englewood Cliffs, NJ: Prentice-Hall, Inc. (Original work published 1981).

Ishikawa, K. (1991). Foundation and approach in Japan by an emminent Japanese Professor. In R.J.Pierce (Ed.), Leadership, perspective, and restructuring for total quality : an essential instrument to improve market share and productivity by emminent leaders of America's most competitive companies. (pp. 193). Milwaukee, WI: ASQC Quality Press.

Juran, J. M. (1964). Managerial breaktrhough. New York: McGraw-Hill.

Juran, J. M. (1981). Product Quality--A prescription for the West. Management Review, 70, 9-14.

Juran, J. M. (1983). Upper management and quality. New York: Juran Institute, Inc.

Juran, J. M. (1988b). Juran on quality planning. New York: The Free Press.

Juran, J. M. (1988a). Upper management and quality. In J.M.Juran & F. M. Gryna (Eds.), Quality Control Handbook (4th ed. ed., pp. 8.1-8.25). New York: McGraw-Hill.

Juran, J. M. (1995). How top executives improve performance. Executive Excellence, 12, 6-6.

Juran, J. M. & Gryna, F. M. (1980). Quality planning and analysis. (2nd ed.) New York: McGraw-Hill.

Kanji, G. K. & Asher, M. (1996). 100 Methods for total quality management. London: Sage.

Kano, N. (1993). A perspective on quality activities in American firms. California Management Review, 35, 12-31.

Kano, N. & Koura, K. (1990). Development of Quality Control Seen Through Compasnies Awarded the Deming Prize. In Reports of Statistical Application Research, JUSE (pp. 79-105). Tokyo: JUSE.

Kano, N., Tanaka, H., & Yamaga, Y. (1983). TQC Activities and Their Economical Effects Seen from the Deming Prize Awarded Enterprises. Hinshitsu (Quality, Journal of the Japanese Society for Quality Control [in Japanese]), 13, 171-179.

Kaplan, R. S. (1964). The conduct of inquiry: Methodology for the behavioral science. San Francisco, CA: Chandler.

Kelada, J. N. (1997). Total Quality: a framework for new management practices. In ASQ (Ed.), (pp. 378-386). Milwaukee, WI: American Society for Quality.

Kelle, U. (1995). Computer-aided qualitative data analysis: theory , methods and practice. Thousand Oaks, CA: SAGE.

Kemper, R. E. (1997). Quality, TQC, TQM: A meta literature study. Lanham, MD: The Scarecrow Press Inc.

Kendall, M. G. & Smith, B. B. (1960). Tables of random numbers (second series). London: Cambridge University Press.

Kilian, C. S. (1992). The world of W. Edwards Deming. (2nd. ed.) Knoxville, TN: SPC Press.

King, B. (1987a). Better designs in half the time. Methuan, MA: GOAL/QPC.

King, B. (1987b). Hoshin planning: The development approach. Methuan, MA: GOAL/QPC.

Kondo, Y. (1988). Quality in Japan. In J.M.Juran & F. M. Gryna (Eds.), Quality Control Handbook (4th ed. ed., pp. 35f.1-35F.40). New York: McGraw-Hill.

Kordupleski, R. E., Rust, R. T., & Zahorik, A. J. (1993). Why improving quality doesn't improve quality (or whatever happened to marketing?). California Management Review, 35, 82-95.

Koyanagi, K. (1960). The Deming Prize. (Rev. Ed. ed.) Tokyo: Nippon Kagaku Gijutsu Remmei (The Union of Japanese Scientists and Engineers).

Krieter, C. (1996). Total quality management versus business process reengineering: Are academicians teaching what businesses are practicing? Production & Inventory Management Journal, 37, 71-75.

Krishnan, R., Shani, A. B., Grant, R. M., & Baer, R. (1993). In search of quality improvement: Problems of design and implementation. Academy of Management Executive, 7, 7-20.

Landes, L. L. (1995). Leading the duck at mission control. Quality Progress, 28, 43-48.

Latzko, W. J. (1981). Quality circles won't work without quality control. The Magazine of Bank Administration, 55, 23-26.

Latzko, W. J. (1986). Quality and productivity for bankers and financial managers. New York: Marcel Dekker.

Latzko, W. J. & Saunders, D. M. (1995). Four days with Dr. Deming: A strategy for modern methods of management. Reading, MA: Addison-Wesley Publishing Co.

Latzko,W.J. (2000, May 08). The underused control chart: Facts, myths, and applications. In ASQ (Ed.), Annual Quality Congress Transactions: Minneapolis, WI: American Society for Quality.

Lau, J. B. & Shani, A. B. (1992). Behavior in organizations: An experimental approach. (5th ed.) Homewood, IL: Irwin.

Lawler, E. E., III (1994). Total Quality Management and employee involvement: Are they compatible? Academy of Management Executive, 8, 68-76.

Lawler, E. E., III & Mohrman, S. A. (1985). Quality circles after the fad. Harvard Business Review, 63, 64-71.

Lawler, E. E., III, Mohrman, S. A., & Ledford, G. E. J. (1992). The Fortune 1000 and total quality. Journal for Quality & Participation, 15, 6-10.

Lawler, E. E., III, Mohrman, S. A., & Ledford, G. E. J. (1995). Creating high performance organizations: practices and results of em-

ployee involvement and total quality management in Fortune 1000 companies. San Francisco, CA: Jossey-Bass, Inc.

Leedy, P. D. (1997). Practical research: planning and design. (6th ed.) Upper Saddle River, NJ: Prentice Hall.

Lehr, S. J., Fornell, C., & Lehmann, D. R. (1993). Economic consequence of providing quality and customer satisfaction (Rep. No. 93-112). Cambridge, MA: Marketing Sciences Institute.

Lengnick-Hall, C. A. (1996). Customer contributions to quality: A different view of the customer-oriented firm. Academy of Management Review, 21, 791-824.

Macdonald, J. (1994). Service is different. TQM Magazine, 6, 5-7.

Mackowski, S. J. (1994). A question of understanding. TQM Magazine, 6, 24-25.

Marcus, D. (1998). Gain a competitive edge with TQM. Modern Casting, 88, 62-62.

Merriam, S. B. (1998). Qualitative research and case study applications in education. San Francisco, CA: Jossey-Bass.

Miles, M. B. & Huberman, A. M. (1994). Qualitative data analysis: An expanded source book. (2nd ed.) Thousand Oaks, CA: Sage.

Mizuno, S. (1988). Managing for quality improvement: The 7 new QC tools. (Productivity Press, trans.). Cambridge, MA: Productivity Press. (Original work published 1979).

Moe, J. L. (1995). What does "employee involvement" mean? Quality Progress, 28, 67-71.

Nakhal, B. & Neves, J. S. (1994). The Deming, Baldrige, and European Quality Award. Quality Progress, 27, 33-37.

Potocki, K. (1995). Finding a common TQM definition [letter to the editor]. Quality Progress, 28, 12-14.

Powell, T. C. (1995). Total Quality Management as a competitive advantage: A review and empirical study. Strategic Management Journal [SMJ], 16, 15-37.

Price, M. J. & Chen, E. E. (1993). Total quality management in a small, high-technology company. California Management Review, 35, 96-117.

Pulat, B. M. (1994). Total quality management: A framework for application in manufacturing. TQM Magazine, 6, 44-49.

Quenouille, M. H. (1959). Rapid statistical calculations. New York: Hafner.

Ramaswamy, R. (1996). Design and management of service processes. Reading, MA: Addison-Wesley.

Rau, H. (1995). 15 Years and still going... Quality Progress, 28, 57-59.

Reger, R. K., Gustafson, L. T., Demarie, S. M., & Mullane, J. V. (1994). Reframing the organization: why implementing Total Quality is easier said than done. Academy of Management Review, 19, 565-584.

Rehder, R. & Ralston, F. (1984). Total Quality Management: A revolutionary management philosophy. SAM Advanced Management Journal, 49, 24-33.

Rhodes, L. A. (1992). On the road to quality. Education Leadership 76-80.

Ricoh of America, I. The quest for higher quality: The Deming Prize and quality control. 1982. Fairfiled, NJ, Author.

Rosander, A. C. (1985). The early history of the Administrative Applications Division. Milwaukee, WI: AAD, American Society for Quality Control.

Rumsey, H. A. & Miller, P. E. (1990). Barriers to Total Quality

Management in the Department of Defense. Logistics Spectrum, 24, 3-6.

Sashkin, M. & Kiser, K. (1992). What Is TQM? Executive Excellence, 9, 11.

Scherkenbach, W. W. (1986). The Deming route to quality and productivity. Washington, DC: Ceepress.

Schmidt, W. H. & Finnigan, J. P. (1992). The race without a finish line: America's quest for total quality. San Francisco: Jossey-Bass Publishers.

Scholtes, P. R. (1998). The leader's handbook: making things happen, getting things done. New York: McGraw-Hill.

Schonberger, R. J. (1992). Total quality management cuts a broad swath - through manufacturing and beyond. Organizational Dynamics, 20, 16-28.

Sen, F. & Latzko, W. J. (1989). Single source supplier strategies--an exploratory study of the impact of values, attitudes and practices in large U.S. manufacturing firms. In C. Huang (Ed.), (pp. 301-305). Atlanta, GA: Academy of Management.

Senge, P. (1992). Building learning organizations. Journal for Quality & Participation, 15, 30-38.

Shewhart, W. A. (1931). Economic control of quality of manufactured product. Princeton, NJ: D. Van Nostrand Company.

Shewhart, W. A. (1939). Statistical method from the viewpoint of quality control. Washington, DC: The Graduate School, The Department of Agriculture.

Shingo, S. (1986). Zero quality control:Source inspection and the poka-yoke system (A. P. Dillon, Trans.). Cambridge MA: Productivity Press.

Shoop, Tom (1991). Uphill climb to quality: Why is total quality

management taking so long to catch on in government? Government Executive, 17-19.

Soin, S. S. (1992). Total quality Control Essentials: Key elements, methodologies, and managing for success. New York: McGraw-Hill, Inc.

Spencer, B. A. (1994). Models of organization and total quality management: A comparison and critical evaluation. Academy of Management Review, 19, 446-471.

Spitzer, R. D. (1993). TQM: The only source of sustainable competitive advantage. Quality Progress, 26, 59-64.

Stoner, J. A. F. & Wankel, C. B. (1990). World class managing: Two pages at a time. New York: Fordham University.

Stoner, J. A. F. & Werner, F. M. (1994). Managing finance for quality: bottom line results from top-level commitment. Milwaukee, WI: ASQC Quality Press.

Tachiki, D. S. (1990). Total Quality Control: The Japanese approach to continuous improvement Tokyo: Sakura Institute of Research.

Taguchi, G. (1981). On-Line quality control during production. Tokyo: Japanese Standards Association.

Talley, D. J. (1991). Total Quality Management : Performance and cost measures : the strategy for economic survival. Milwaukee, Wis.: ASQC Quality Press.

Tamimi,N., & Gershon,M. (1995). A tool for assessing industry TQM practice versus the Deming philosophy. Production & Inventory Management Journal, 36(1), 27-32.

Tamimi, N. & Sebastianelli, R. (1996). How firms define and measure quality. Production & Inventory Management Journal, 37, 34-39.

Tenner, A. R. & DeToro, I. J. (1997). Process redesign: The implementation guide for managers. Reading, MA: Addison-Wesley.

The Random House College Dictionary (1975). The Random House College Dictionary. (rev. ed.) New York: Random House.

U.S.Department of Commerce, N. I. o. S. a. T. Malcolm Baldrige National Quality Award criteria for performance excellence--1998. 1998. Washington, DC, Author.

U.S.Department of Defense & Office of the Deputy Assistant Secretary of Defense for Total Quality Management (1989). Total quality management guide: Key features of the DoD implementation of TQM (DoD 5000.51G final draft) (Rep. No. DoD 5000.51 Final Draft).

U.S.General Accounting Office (1991). Management Practices: U.S. Companies Improve Performance Through Quality Efforts (Rep. No. GAO/NSIAD-91-190). Washington, DC: Author.

Waldman, D. (1994). The Contributions of Total Quality Management to a Theory of Work Performance. Academy of Management Review, 19, 510-536.

Waters, F. C. (1996). An examination of barriers to the application of the management theories of W. Edwards Deming. Texas Tech University.

Wellins, R. S., Ginnodo, W. L., & Day, C. R. J. (1993). TQM Forging ahead or falling behind? Pittsburgh, PA: Development Dimensions International, Inc., Quality and productivity Management Association, and Industry Week.

Western Electric Co. (1956). Statistical quality control handbook. Charlotte, NC: Author.

Wheeler,D.J. (1995). Advanced topics in statistical process control. Knoxville, TN: SPC Press.

Wheeler,D.J. (2000). If it ain't broke, don't fix it. The Quality Management Forum, 26, 10-12.

Wilcox, M., Dale, B. G., Boaden, R., & McQuater, R. E. (1995). Using Quality Tools and techniques successfully. Frodsham, Cheshire,

UK: TQM International.

Woods, J. A. & Cortada, J. W. (1995). QualiTrends: 7 Quality Secrets that Will Change Your Life. New York: McGraw-Hill.

Yin, R. K. (1994). Case study research: design and methods. Thousand Oaks, CA: Sage.

Zbaracki, M. J. The rhetoric and reality of Total Quality Management. Administrative Science Quarterly (in press).

Zeleny, M. (1988). What is Integrated Process Management? Human Systems Management, 7, 265-267.

Zuckerman, A. (1994). EC drops ticking time bomb. Industry Week, 243, 44-51.